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BUREAU OF COMMERCIAL FISHERIES

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Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget November 23, 1956.

0.32 ELECTRON-MICROSCOPIC STUDY OF FINBACK WHALE MYOGLOBIN CRYSTALS

Bradley, D. E. (Associated Electrical Industries, Ltd., Berks, England)
Nature 183, 941-943 (April 4, 1959)

Introduction.--Myoglobin, a protein fraction, has been studied in detail by X-ray analysis, and a three-dimensional model of the molecule has been constructed from the information obtained. The dimensions of the molecule are 43 Ångstrom units (A.) by 35 A. by 23 A., which is within the limit of resolution of the electron microscope and existing techniques of specimen preparation. These molecules, or at least structures related to the unit cell, should be visible in crystalline myoglobin with aid of the electron microscope. The dimensions of any structures observed could then be related to the X-ray results.

Two possible approaches to the electron microscopy of protein crystals are available. The specimen can be examined either in transmission or by means of replicas, which give a picture of the surface topography. In the case of transmission, very thin crystals must be used to permit penetration by the electron beam. For use with replicas, a technique that permits the attainment of reasonably high resolution is required. Electron micrographs of the myoglobin lattice have been obtained by both methods, but the most useful information so far has come from surface replicas.

Experimental.--Myoglobin, which crystallizes in different forms, can be obtained from many different animals. In this study, the myoglobin was obtained from the finback whale and recrystallized from sodium and potassium phosphates. The resulting crystals were type-F myoglobin. According to an X-ray analysis of type-F myoglobin crystals as described by Kendrew and Pauling (1956), the crystal habit is orthorhombic with the crystals being in the form of six-sided plates with two flat faces,

(over)

ABSTRACTER: Martin Heerdt

2.111 SYNTHETIC DRIFT NETS - SOME PRELIMINARY OBSERVATIONS

Richardson, I. D. (Fisheries Laboratory, Lowestoft, England)
World Fishing 8, 76-78 (April 1959)

Herring fishermen in England are interested in the possibility of using the new synthetic fibers as a replacement for cotton in the construction of drift nets. This changeover presents a number of problems including the question of the best mesh size to use. Whether a given mesh size has the same effective catching power with both the synthetic and the organic fiber can be resolved only by actual comparisons of catches.

Before comparative fishing trials are made, it is advisable to obtain information about the properties of the two materials including the effect of water on the dry mesh and the effect of differences in specific gravity on the way the net hangs. Synthetic fibers have a lower specific gravity than that of cotton. A net constructed of nylon, for instance, will be lighter in the water than one made of Terylene, and this in turn will be lighter than a net constructed of cotton.

Underwater observations.--With the question of rigging in mind, a number of nets made from a synthetic fiber were observed in comparison with several normal, tanned cotton nets that had been rigged in the English manner without weights and with 72 corks, using 2-fathom strops. The nets and warps were soaked for 48 hours before any observations were made.

To obtain data on the underwater behavior of the nets, a weighted line that had been marked off in half fathoms was hung over the side of a dingy, and a frogman was asked to compare the level of the headline with the measured line as the dingy was pulled slowly along the net.

Only one type of synthetic material was compared with the standard cotton net, so the results observed do not necessarily apply to nets made of other synthetic materials.

(over)

ABSTRACTER: Kathryn L. Osterhaug

0.33 THE REACTION OF ADENOSINE TRIPHOSPHATE WITH DYES

Braun, A. D. and Nemchinskaia, V. L.
Biochemistry (U.S.S.R.) 23, No. 3, 341-345 (May-June 1958)

The vital staining of tissues by dyes depends upon the proteins that are contained in the cells. This theory is based upon the ability of specific proteins to combine with dyes as well as upon the predominance of protein over the other constituents of protoplasm. The nonprotein constituents of protoplasm--such as polysaccharides, lipids, and nucleic acids--do, however, have a definite effect on the staining properties of cells. The nucleic acids in particular are thought to be involved in the staining with alkaline dyes.

Adenosine triphosphate (ATP) is a constituent of protoplasm that reacts with dyes. The concentration of ATP in skeletal muscle is almost 0.005 M. The presence in ATP of many kinds of chemical groups including both those that are acidic and those that are basic suggests the possibility that it may react both with acidic and with basic dyes.

Experimental.--Chromatographic analysis of a commercially prepared ATP product showed that it contained adenosine diphosphate and adenosine monosphosphate. The content of inorganic phosphorus was less than 0.5 percent.

Samples of ATP dissolved in distilled water and adjusted to a given pH with 0.1 N sodium hydroxide were treated with the following dyes: methylene blue, toluidine blue, Nile blue sulfate, neutral red, and Congo red. A spectrophotometer was used in most cases to detect any reactions between ATP and the dye. In other experiments, a method was used that involved (1) the dialysis of the mixture of ATP and dye through cellophane and (2) diffusion on gelatin.

The experiments were carried out as follows: 3 milliliters (ml.) of buffered ATP solution was

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ABSTRACTER: Kathryn L. Osterhaug

2.6 THE EUROPEAN COMMON MARKET AND THE UNITED STATES FISHING INDUSTRY

Lopp, Thomas G. (Division of Industrial Research and Services, U. S. Bureau of Commercial Fisheries, Washington 25, D. C.)
Commercial Fisheries Review 21, 13-20 (January 1959)

Six western European nations--Belgium, Netherlands, Luxembourg, Federal Republic of Germany (West Germany), France, and Italy--have agreed to unite their economies by eliminating tariffs among themselves and by establishing a uniform external tariff structure toward the rest of the world. To permit gradual adjustments to new conditions, the six countries will develop this new economic union, known as the European Common Market (also known as the European Economic Community), over a period of 12 to 15 years and arrive at a complete customs union at the end of that period. The United States and other parties to the General Agreement on Tariffs and Trade (GATT) will seek to insure that the six countries form their new tariff structure in conformance with the principals of that Agreement.

Since the United States exports up to 90 percent of its production of menhaden oil to the Netherlands and West Germany, the United States has a direct interest in the Common Market tariffs to be established on this and other competitive oils.

The six Common Market countries tentatively plan to base the new tariff rates on the averages of present import fees. At present, menhaden oil enters the Netherlands and West Germany duty free. Belgium and Luxembourg have an import tax on fish oils; France and Italy have import duties on these oils. A new uniform tariff rate on menhaden oil based on the average import fees of the six countries might be as high as 13 percent ad valorem.

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Author's summary

0.33

placed in a cellophane bag, which was immersed in a beaker containing 10 ml. of dye solution ($0.3 \cdot 10^{-3}$ M). The salt concentrations and pH of the inner and outer solutions were equal. In control experiments the bag contained 2 ml. of buffered solution but no ATP. Dialysis took place at 4° to 6° in a refrigerator for 4 hours. The amount of dye in the inner and outer liquids then was determined, as well as the amount adsorbed on the walls of the bag. Determination of the dye was carried out with an FEK - M photometer. See table 1 (below).

It was easy to see visually differences in penetration of dye into the gelatin. In samples that contained ATP, the depth of penetration of dye into the gel was always greater than it was in the controls. The dye did not concentrate on the gelatin surface, but penetrated it diffusely.

Summary.--Adenosine triphosphate changes the nature of the diffusion of basic and acidic dyes through cellophane and into gelatin and also affects the properties of the spectra of dye solutions in the visual field. The data suggest disaggregation of the dyes by the action of ATP due to the formation of a complex of ATP with the dyes.

Table 1.--Effect of adenosine triphosphate on dialysis of dyes

Dyes	Duration of experiment hours	ATP in mg./ml.	Concentration of buffer, in M		pH	Sample absorption in E						II/I	IV/III
						Control			With ATP				
			Acetate	Phosphate		Outside I	Inside II	Walls	Outside III	Inside IV	Walls		
Methylene blue	40	2.4	0.05	--	5.0	0.59	0.43	0.17	0.58	0.74	0.14	0.72	1.27
The same	40	1.2	0.1	--	6.0	0.44	0.32	0.13	0.36	0.38	0.12	0.72	1.05
same	41	2.4	--	0.06	7.2	0.42	0.37	0.13	0.39	0.42	0.11	0.88	1.07
same	41	1.2	--	0.06	7.2	0.42	0.37	0.13	0.48	0.44	0.10	0.88	1.02
same	41	0.6	--	0.06	7.2	0.42	0.37	0.13	0.40	0.42	0.12	0.88	1.05
Neutral red	40	2.4	0.1	--	6.2	0.37	0.21	0.32	0.55	0.46	0.24	0.56	0.83

0.32

two inclined side faces, and four vertical side faces. This form of crystal is particularly suitable for electron microscopy, since the flat face will be predominant and easily recognizable and the vertical faces will be distinguishable from the inclined faces.

Results.-- The author obtained electron micrographs of the three crystal faces mentioned above and discovered that the flat and vertical faces showed a periodic structure. This consisted of dark parallel lines that on close examination proved to be grooves rather than steps. The spacings as measured on a number of micrographs of different crystals showed an average value of 88.5 A. on the flat face and 114.5 A. on the vertical face.

Assuming that the grooves correspond to the unit cell structure, the spacings observed on the flat face should be equal to a, which is defined along with b and c in figure 1, not shown here, and the spacings on the vertical face should be equal to the projection of a, which is $\sqrt{a^2 + 4b^2}$. A value for b obtained by equating this expression with the observed 114.5 A. was found to be 36.5 A. The experimental values $a = 88.5$ A. and $b = 36.5$ A. are consistent with the unit cell dimensions of the dry crystals.

No periodic structures from which the value of c could be calculated have been observed, but an approximate value can be estimated from the layer growth structures that have been observed on the flat faces. The thicknesses of the layers can be calculated from the length of the shadow, and they should correspond to an integral number of c spacings. A large experimental error arises because the crystals may be tilted to give a range of different shadowing angles. The value obtained in this way is (43 ± 15 A.). This result is in keeping with the c dimensions for dry crystals if the experimental error is accounted for.

Conclusions.-- The results obtained here for the cell dimensions of type-F myoglobin agree well with the results of Kendrew and Pauling. This indicates that the electron microscope can be used for providing reliable data for the evaluation of the crystal structures of materials difficult or impossible to study by X-rays.

2.6

Margarine producers in the Netherlands and West Germany use United States menhaden oil as an ingredient of margarine because they can obtain it in large volume at a low price. Several organic oils are used somewhat interchangeably, the proportion of each depending on the price of individual oils and on the grade of margarine being produced. Since menhaden oil enters this trade on the basis of its low price, an import duty established by the Common Market countries would lower its competitive position.

In addition to tariff changes, the Common Market includes an agriculture-expansion program and a program to fully use and develop the resources of member nations. These programs may also retard the imports of menhaden oil. Under these programs, should the six nations decide to expand their own production of organic oils, imports may be limited or excluded.

Even without trade restrictions, the European margarine processors who now use menhaden oil may turn to the use of other ingredients. In anticipation of a need for new markets, United States chemists are attempting to find new uses for menhaden oil.

On other United States fishery products, the European Common Market probably will establish import tariffs that will be higher than the tariffs now enforced by the principal importing countries of the new economic union. The six countries also could exclude imports of fishery products altogether in an attempt to build up their own fisheries under the proposed programs mentioned. However, the United States now exports only small quantities of canned salmon, canned sardines, and other food fish to Common Market countries and even the complete exclusion of those fishery products would have little immediate effect on the food-fish fisheries of the United States. But in the future, if the Common Market countries improve their economy and develop increased purchasing power for dollar goods, and if liberal trade policies prevail, the six nations may increase their buying capacity for United States fishery products.

2.111

A rough estimate was made of the difference in weight in sea water of the synthetic net as compared with the cotton net, and as a result, corking of the synthetic net was reduced from 72 corks on the cotton net to 55 corks, 50 corks, and 45 corks, respectively, on three synthetic nets.

The headline on the bottom net with 72 corks bowed up slightly, most of the bow being between the strop and 2 fathoms along the headline from the strop. Farther along, the headline remained flat and descended again to the strop within 2 fathoms of it. The maximum difference between the highest and lowest point on the headline of the cotton net was $1\frac{1}{2}$ feet.

On the headline of the synthetic net the frogman observed an upward bow of well over 6 feet on the net carrying 55 corks, 3 feet on the net carrying 50 corks, and $1\frac{1}{2}$ feet on the net carrying 45 corks. The net carrying 55 corks also had a tendency for distortion of the meshes in different parts of the net. The footrope of the net carrying 45 corks bowed upward at least 6 feet.

The effect of bowing upward of the footrope was to distort the meshes, with the lines of distortion starting from the footrope at the side of the net and running diagonally toward the middle of the net. Leads were added to the footrope of the net carrying 45 corks to give a total weight of 60 ounces. This reduced the bow in the footrope to about $1\frac{1}{2}$ feet, which made the rig approximate closely the shape of the cotton net and eliminated the distortion of the meshes.

To compare the effect of soaking, the comparative mesh sizes of a synthetic net and a cotton net were determined. Results indicated that the fishing size of the cotton net was considerably smaller than the dry mesh size, whereas the fishing size of the particular synthetic net dealt with was essentially the same both wet and dry.

2.1121 AN IMPROVED DESIGN FOR SMALL TRAWL DOORS

King-Webster, W. A.
World Fishing 8, 40-42 (January 1959)

The trawl doors described in this article were developed for use with a 27-foot double-ended launch powered by a 22 brake horse power (b.h.p.) diesel engine. The advantages of these doors are that they are cheaper, easier to construct, lighter to handle, and much more convenient to adjust for varying fishing conditions than are the doors they were designed to replace.

The doors are 36 inches long by 24 inches high; are built of ½-inch boarding running vertically; and are backed by three horizontal battens, each 36 inches by 3 inches by 1 inch. Fastenings are 2-inch galvanized wire nails with the ends bent over. The ideal wood to use is tough, reasonably light, and not subject to warping.

Sufficient ballast normally is provided by a plate of iron or steel measuring 36 inches by 3 inches by ¼ inch, with its leading end cut in a curve to form a runner. The plate is bolted to the lower batten of the door, and the wood is trimmed to the same curve as the metal. On soft ground, there is no need for a metal shoe to protect the wood from chafing on the bottom, as there is when the gear is used over hard grounds.

The ballast at the bottom of the doors causes them to remain on end if the boat stops towing and thus tends to prevent tangling when fishing is resumed.

The towing bridle consists of three short pieces of ¼-inch galvanized chain. The upper chain is 20 inches long, the after chain and its shackle 16 inches, and the lower chain 18 inches. The lower chain is shorter than the upper in order to make the door dive. A ring, 2 inches in diameter, is

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 ABSTRACTER: Kathryn L. Osterhaug

2.116 NEW TRAWL DEVICE SAVES NET LOSS; TELLS HOW MANY FISH IN COD-END

Anonymous
Western Fisheries 57, 28 (February 1959)

A new electronic device which fits easily on a conventional trawl winch, and which not only saves the net from being torn or lost, but tells with accuracy how many fish are in the net, is in the process of being patented by an Italian inventor.

The device is the successor to an earlier invention which told only how many fish were in the net. Inventor, Ciriaco Valetti of Venice, Italy, said that his new device is a very simple arrangement of great value to the trawling fleets of the world. It will be especially useful to deep-sea trawlers, and boats dragging in rough waters, such as the B.C. trawl fleet in Hecate Strait.

The device consists mainly of two hinged collars attached to the terminals of the winch. Two dynamometers fitted with electroacoustical devices are coupled to the collars, and anchored to the deck.

Main purpose of the invention is to avoid destroying the net on rough bottom, or on obstacles unseen on sounding equipment. It will also, by measuring the strain on the towing lines, give an accurate picture of how many fish are in the net.

A warning signal, working through a voltmeter, is placed on the bridge and in the engine room, giving a permanent and instantaneous reading of the strains developed by the trawl. A horn is sounded, and red light flashes immediately the net becomes fouled on the bottom or on an obstacle.

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 Reprinted in part

2.115 GLASS REINFORCED PLASTIC HULLS

Laszlo, Patrick D. (Portsmouth, England)
Norwegian Fishing News 6, No. 1, 23-26 (1959) (Bergen, Norway)

Glass-reinforced plastic can be used for the hulls and decks of fishing vessels up to 130 feet in length. Glass-reinforced plastic consists of a laminate made of several layers of 2-ounce-per-square-yard glass fiber mat impregnated and bonded together with cold-setting polyester resin. This type of glass-reinforced plastic is referred to as Polyester/Mat or P/M.

The cold-setting polyester resin is an almost colorless liquid that can be stored for considerable periods in a cool place. It is activated by the addition of small quantities of two other chemicals, one of which acts as an accelerator and the other as a catalyst. These cause the resin to set within a predetermined period of time. For boat-building purposes, it is usual to arrange for the resin to set in 30 minutes.

Glass mat is made of short lengths of glass threads disposed at random and loosely held together like coarse felt. The glass threads are composed of glass fibers each of which is about one-tenth the thickness of human hair. Glass fibers are astonishingly strong and flexible.

Method of construction.--Glass mat is laid into a mold and impregnated with polyester resin by a "wet layup" process. This process consists of the following: (1) The surface of the mold is treated first with a separating agent such as wax to ensure that the laminate will not stick to the mold. (2) A skincoat is then applied by painting or spraying the surface of the mold with a film of polyester resin. This film, which usually is colored, eventually becomes the outside surface of the laminate. (3) The next stage is to apply a layer of glass scrim and resin. Glass scrim is a loosely woven cloth.

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 ABSTRACTER: Kathryn L. Osterhaug

2.3 HERRING WASHING MACHINE

Anonymous
Norwegian Fishing News 6, No. 1, 18 (1959) (Bergen, Norway)

A firm in Bergen, Norway, manufactures a herring washing machine that has been installed in a number of Norwegian freezing plants. This machine has contributed to the improvement of quality of the products and has improved the utilization of herring byproducts.

The herring washing machine consists of (1) a washing vat, (2) a combined conveyor and rinsing belt, and (3) a collecting silo provided with a shut-off hatch.

The machine requires a floor space of about 6.5 x 1.5 meters. The conveyor belt is made of steel bolt chain with riveted galvanized slats or netting. Power is provided by an electric motor (3 h.p., 50 cycles, 3 phase 220 V AC) with chain transmission.

The machine is equipped with friction coupling and a protective motor switch that begins to function if the machine is accidently overloaded, thus preventing wear and tear of machine parts.

When the herring are emptied into the washing vat, an adjustable device forces them under water and up onto the conveyor belt. Here they are rinsed and then collected in a silo at the end of the belt. All scales are conveyed in water troughs to a vibrating screen leading to boxes in which the scales are collected. Operation of the machine is very simple.

Experiments with this washing machine were begun in 1935 to 1936. Through the years it has been improved and is now considered to have achieved its final design. Among the many Norwegian

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 ABSTRACTER: Kathryn L. Osterhaug

2.115

(4) When the scrim boat has hardened, successive layers of 2-ounce glass mat impregnated with resin are applied until the desired thickness has been built up.

Hulls that are less than 30 feet in length require only three layers of mat, which means that they will be about 3/16 inch thick. Hulls that are 30 to 40 feet long require 4 to 5 layers, 40- to 56-foot hulls require 6 to 7 layers, and 57- to 80-foot hulls require 7 to 10 layers of glass mat.

Strength and rigidity.--The tensile strength of polyester resin by itself is about 8,000 to 9,000 pounds per square inch. After it has been reinforced by 2-ounce glass mat, the minimum tensile strength of the resulting laminate is 15,000 pounds per square inch. Because the mat is composed of glass threads that are disposed in all directions, the laminate has tensile strength in all directions.

Although P/M laminate is strong, it also is flexible. A P/M hull is made both stronger than timber and equally rigid by stiffening the skin of the hull with hollow P/M "top hat" transverse frames similar to the frames used in a timber hull. The frames are made by molding P/M over thin aluminum formers.

2.3 (Cross Reference: 2.2)

freezing plants employing this washing machine is the Bergen Fiskeindustri, perhaps the largest freezing plant of Europe. The use of conveying belts, which transport the herring directly from the ship, saves time and working power because the washing machines, and eventually the weighing machine, may be coupled into the conveying system.

The capacity of the washing machine is 8 to 10 tons per hour for the largest type and 4 to 5 tons per hour for the smallest type.

2.1121

welded through the ends of the three chains. The end of the towing warp is shackled to this ring. Heavier chain may be advisable.

The after chain is shackled to a strip of iron measuring 16 inches by 1½ inches by ¼ inch with a ¾-inch hole bored in either end that is bolted to the door on top of a wooden wedge. The wedge is 12 inches long and rises to 3 inches in height. The bolts go through the central batten on the other side of the door. The wedge is to cant the front of the door outwards as soon as a strain comes on the gear in order to start the door planing.

The upper and lower chains go through 1-inch holes bored through the doors, are as close to the inner edges of the battens as possible, and are 8 inches from the front of the door.

The net is towed from the end of the iron strip as shown in the diagram. The adjustment of the doors is simple. The after chain is never altered. To make the doors fish wide apart, both upper and lower chains are lengthened; to make them fish closer, both chains are shortened. To make them fish deep, the lower chain is shortened; to make them fish shallow, upper and lower chains are about equal.

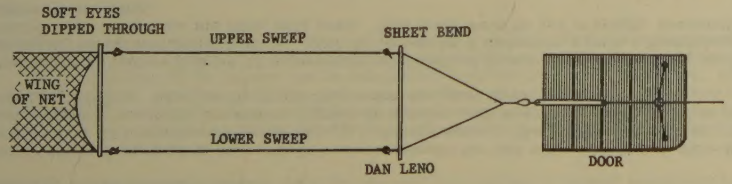
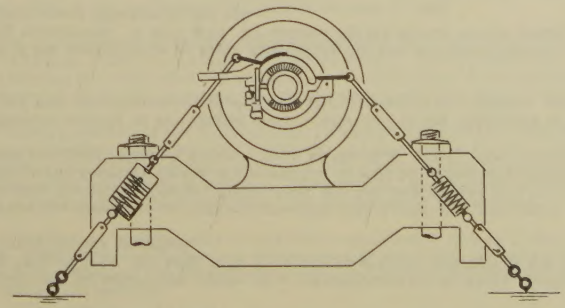


Figure 2. Method of rigging the gear

2.116

The device is so set up on the winch that it automatically disengages when the strain reaches the danger level. When this brake is released the winch is then running free, letting out line until the net is free, or until the ship is stopped or diverted.

A San Francisco company is negotiating with the inventor for manufacturing rights, and it is expected the new device will be on the market within a year. Patents are pending in the U. S., Canada, Italy, and Norway, and manufacturing rights throughout the world have been reserved for a year.



Device fits on side of trawl winch. Collar is fastened to axle of winch, but can be easily unhinged for normal operation. Lining, similar to auto brake lining, is fitted tightly around axle. Variation of strains coming from towing lines is transmitted through the winch axle to the bearings in the collar, and then to the spring of the dynamometer. Voltmeters then register strain.

2.6 IMPROVEMENT IN QUALITY OF ICED WHITE FISH. TEMPERATURE CONDITIONS AT INLAND MARKETS AND RETAILERS' PREMISES

Anonymous
Food Investigation 1957, Report of the Food Investigation Board (Great Britain), pp. 7-9 (1958) (London)

The results of a survey of the temperature of fish at ports and on coastal premises of merchants have been reported. To cover the rest of the distribution chain, about 8,000 temperature readings were obtained in the early morning at wholesale markets in Billingsgate, Birmingham, Leeds, Manchester, and Glasgow, and a further 8,000 temperature readings were obtained in about 100 retail shops in the surrounding districts at different periods throughout the day. Over 4,000 additional temperatures were taken in the London depot of a large firm. The following provisional results can be reported.

At the London rail depot between midnight and 4 a.m., the temperatures of arriving boxed wet fish averaged 36.6° F., with temperatures of 90 percent of the fish ranging between 32° and 41° F. At Billingsgate between 6 a.m. and 9 a.m., the temperatures of the fish averaged 37.7° F., 90 percent ranging between 32° and 44° F. At the other wholesale markets, the temperature distribution was very similar. The average temperatures of fish from different ports were within a degree or so of the overall average of 38° F. Imported fish were noticeably cooler, about 34° F., with 90 percent of them ranging between 32° and 39° F. Imported fish reconsigned to another market without being protected by adequate ice warmed up--in one instance, to an average temperature of 50° F. Fillets were a little warmer than whole fish--especially fillets from Aberdeen that were at 40.2° F. as compared with whole fish at 36.4° F.

Wet fish held overnight at the markets had practically the same temperature distribution as had fish arriving from the ports. At Manchester, however, temperatures were lower; they averaged

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 ABSTRACTER: Martin Heerdt

3.12 CHLORTETRACYCLINE AND RED SNAPPER

Anonymous
Seafood Merchandising 19, 27, 46 (April 1959)

As far back as 1944, researchers reported that the bacterial spoilage of whole eviscerated fish was significantly retarded by the application of chlortetracycline.

By 1954 a method of preparing ice containing chlortetracycline evenly dispersed throughout the block had been developed. Later research resulted in an extension of the shelf life of edible fish by the use of chlortetracycline ice or chlortetracycline dip solutions.

Among the most recent work in this field is that with red snapper, caught on the mud bottom of the Gulf of Mexico. The fish were of uniform size and were all obtained at one catch. They were gutted and rinsed in chilled sea water, which was the normal practice on this boat. The fish were immediately treated with chlortetracycline dip solutions, ice containing chlortetracycline, or dips plus ice.

Ice containing 5 p.p.m. chlortetracycline had been prepared. Dipping solutions containing 10 p.p.m. chlortetracycline were prepared by dissolving 0.33 gram chlortetracycline in 33 liters (9.7 gallons) of sea water. Each sample group of 10 fish was dipped for 20 minutes in the solution or in sea water. Each group was then iced in an individual soft drink box. The boxes were examined three times daily and the appropriate ice was replenished as needed.

On the 13th day of storage, the control samples began to have a fishy odor. The samples dipped in chlortetracycline solution or packed in chlortetracycline ice had no odor up to the completion of the trip on the 18th day. Upon arrival at the dock, all fish were rinsed in fresh water, which is the practice at this dock. At this point, two samples were dipped in sea water containing 10 p.p.m.

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2.01 IMPROVEMENT IN QUALITY OF ICED WHITE FISH. FACTORS AFFECTING QUALITY AND TETRAZOLIUM COLOR TEST

Anonymous
Food Investigation 1957, Report of the Food Investigation Board (Great Britain), pp. 3-4 (1958) (London)

Factors affecting initial quality and keeping quality.--As was previously reported, the spoilage rate of codling that were caught off Aberdeen and stowed in ice under identical conditions was found to vary from catch to catch. The season of the year may be a possible factor in this variation. Other factors not directly linked with season also appear to be involved. In continuing this investigation, an examination was made of the spoilage behaviour of three separate lots of cod taken in July from (a) the North Sea, (b) the Faroes, and (c) the North Cape. A possibility exists that the influence of factors such as maturity, reproductive cycle, feed, and race also may be determined by taking samples of fish on the same three grounds at three different times of the year.

Data obtained in July appear to confirm the previous finding that catches taken from the same ground, even within an hour of each other, may spoil at different rates. These differences, however, were less marked than were those found in fish from the different fishing grounds. Codling from the North Cape spoiled most rapidly, codling from the North Sea were intermediate in spoilage, and codling from the Faroes spoiled least rapidly. The slowest spoiling codling from the Faroes reached the point of inedibility some 5 to 6 days later than did the fastest spoiling codling from the North Cape.

The variations are as yet unexplained, but some probable significant differences in the condition of the three lots of codling were observed. As compared with codling from the other grounds, North Cape fish were not feeding, were relatively thin, and had a lower ratio of weight to length. The

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 ABSTRACTER: Martin Heerdt

3.23 TECHNICAL NOTE NO 52 - RECOMMENDATIONS FOR PROCESSING FISHERY PRODUCTS FOR LOW-SODIUM DIETS

Anonymous
Commercial Fisheries Review 21, 33-36 (April 1959)

The use of fishery products by hospitals recently has dropped because the American Heart Association revised its recommendations for patients on low-sodium diets. Only slight changes in the processing of fishery products are necessary in order to remedy this situation.

Both marine and fresh-water species of fish contain sodium in amounts that are well below the prescribed upper limits for foods that may be included in low-sodium diets. The prohibition against their consumption therefore is based solely on the sodium added during processing.

Although sodium added to fish during processing usually takes the form of ordinary table salt that is absorbed by the flesh during brining, it may result from the in-process use of lye (sodium hydroxide); of sodium benzoate, sodium propionate, or sodium bisulfite as preservative or enzyme inhibitors; or of sodium alginate or monosodium glutamate as a glaze material or a flavor enhancer. Sodium also may be introduced as the result of using water that contains sodium in greater concentration than 5 milligrams in 8 ounces.

Recommendations.--The following processor guidelines recommended by the Bureau for reducing the sodium content in processed fishery products have been developed from the point of view of the frozen-groundfish fillet industry, but they can be easily adapted to the canned fish industry.

1. Survey carefully the entire processing line to determine that no unrecognized sources of

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 ABSTRACTER: Kathryn L. Osterhaug

2.01

initial bacterial load on the skin and the rate of increase in bacterial load during stowage in ice were smaller in codling from the Faroes than they were in codling from either of the other grounds. Differences in the types of bacteria present also were observed, particularly with codling from the North Cape and from the Faroes.

Objective assessment of freshness.--Attention is being concentrated upon the possibilities of the tetrazolium color test. This report for the year 1956 referred to a need for a more convenient form of tetrazolium test for commercial application. Test papers in use at that time were (a) impregnated with a single concentration of tetrazolium salt and (b) read after use by photometric estimation of the color obtained by elution. The direct matching of colors on such test papers with color standards was not practical. Considerable progress has been made by using test papers containing three separate bands, each with a different concentration of the salt. These papers are laid moist on the surface of the fish for 3 minutes and are removed and examined 12 minutes later, after the color has developed fully. Trials in the laboratory with codling at various stages of spoilage in ice showed that four color reactions, and therefore four grades of freshness, could be distinguished. Fish held for 3 days in ice showed no color in any band and were grade I. Fish held for 5 to 8 days in ice showed color only in the highest concentration band and were grade II. Fish held for 10 to 13 days in ice showed colors only in the two higher concentration bands and were grade III. Fish held for 14 days or more in ice showed colors in all three bands and were grade IV.

These four grades roughly correspond to those that have been assigned to North Sea haddock and codling by taste-panel scores and by an estimation of the total volatile bases and trimethylamine in the flesh. As a result of these experiments, banded tetrazolium papers appear to provide an accurate and rapid check against the sensory grading of fish under commercial conditions.

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35.5° F. and ranged from 32° to 43° F. At Manchester all boxes apparently are opened and re-iced before overnight storage; whereas at Billingsgate ice is usually merely stacked on top of piles of boxes, and at Birmingham the boxes of fish are held over in a chill store.

At fish shops between 10 a.m. and noon, the temperatures of all boxed fish averaged 42.3° F., fillets averaged 44.3° F., and whole fish averaged 40.9° F. The temperatures of fish being washed and filleted in the back of the shop averaged 47° F.; 90 percent were between 36° and 56° F. The temperatures of wet fish exposed on the refrigerated slabs averaged 55.6° F.; 90 percent ranged between 46° and 66° F.

With an outside air temperature of about 64° F., the average inside temperature of 12 open-front shops was the same as that outside; whereas for 9 closed shops it was only 1° F. higher, and the corresponding average wet-fish temperatures were 53° and 54° F. With an outside air temperature of about 73° F., the average inside air temperature of 11 open shops was 4° F. cooler than outside; whereas the average temperature for 4 closed shops was only 2° F. cooler, with the corresponding average wet-fish temperatures being 59° and 61° F. The direction in which a shop faced seemed to have only a slight effect on the average air and wet-fish temperatures in the shop.

Most shops visited had chill rooms, and temperatures of fish sampled therein averaged 40° F., with a range of 29° to 56° F., depending upon the time the fish were in the chill room. Some freezing and superficial drying of fish in the chill room were noted. A few of the shops used ice chests and thus avoided desiccation and partial freezing. The temperatures of fish kept in this way averaged 41° F. and ranged from 32° to 60° F. Refrigerated slabs were not common, and on most of those seen, either cooling of the fish was relatively ineffective or excessive desiccation resulted from large temperature gradient. Most refrigerated slabs seemed to keep the fish 10° to 20° cooler than the air temperature of the shop if the air temperature was in the 60's. In one case, where the sun was shining on a chilled display cabinet, the temperature of a fillet inside was 73° F.; whereas the shop temperature was 70° F., and the air temperature over the slab was 61° F.

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sodium exist that have not been taken into account. Such possible sources may include (1) washing and rinsing water, (2) brines, (3) preservatives, (4) flavor additives, (5) breading materials, (6) gelling agents, and (7) glazing materials.

2. Obtain information on the sodium content of wash and rinse waters. If the sodium content is in excess of 5 milligrams per 8 ounces, use another water source. Consult with the local Public Health groups as to the sodium content of the local drinking-water supply.

3. Eliminate the use of sodium chloride brines for dipping and washing fillets.

4. If flavor is considered lacking in the finished product, add lemon juice or approved liquid spices to the plain water in the dipping tank.

5. Do not use sodium-containing preservatives, flavor enhancers, or enzyme inhibitors. Look at the label; the appearance of the word, sodium or soda, or of the chemical symbol for sodium, Na, should be a warning sign.

6. Obtain periodic reports on the sodium content of the finished produce to ensure continued compliance with the prescribed sodium limitations of 100 milligrams per 100 grams of product.

7. Conspicuously label the pack as complying with the requirements for a low-sodium diet. The label-face could contain the following types of phrases: "Low-Sodium Diets," "Low-Sodium Dietetic," or "Suitable for Low-Sodium Diets." The term "dietetic," since it may refer to several types of specialized dietary products, is not wholly satisfactory when used alone on the label. The ingredient legend then (1) should plainly state "contains no added salt," (2) should show the sodium content per ounce in milligrams, and (3) should show the sodium content per 100 grams. "Low-Sodium" label declarations are subject to the Food, Drug, and Cosmetic Act. Mislabeled products may be seized by the U. S. Food and Drug Administration.

8. Plan a coordinated promotion campaign to alert the institutional trade and the individual consumer that products are available that are designed for sodium-restricted diets.

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chlortetracycline--Sample 1, treated earlier with chlortetracycline ice, and Sample 2, which had been treated first with the chlortetracycline dip solution and then with chlortetracycline ice. After examination each sample was placed in an individual polyethylene bag, frozen, and shipped by air to the laboratory for further study.

The treated fish were far superior to the controls as evidenced by firmness, color, and lack of both odor and slime. The control fish were soft, odorous, and slimy and had the dull glazed appearance of stale fish.

Upon receipt in the laboratory, the fish were thawed and placed under their respective ices, that is, chlortetracycline ice or regular ice. Their age at freezing was 18 days. For the purpose of this experiment the post-mortem age was considered to be 19 days at the time of thawing. Microbial counts, were run on the 18th, 21st, 25th, 28th, 32nd, 35th, and 39th days by standard plate count technique. This was accomplished by removing a 1-inch center steak with the skin and scales. The steaks were blended with three parts of sterile distilled water on a weight basis. Appropriate dilutions were made and plated out on Difco nutrient agar. Colonies were counted after 2 days of incubation at 25° C.

The microbiological count of the control fish was already markedly higher than that of the treated samples at the 18th day when lab work began. (Small-scale processing generally induces earlier spoilage of fish due to the increased handling.)

High chlortetracycline values were obtained whenever the fish were stored in chlortetracycline ice and particularly when they were dipped in a chlortetracycline solution before and after icing.

3.230 FROZEN FOOD TECHNOLOGY AND PACKAGING

Mehrlich, Ferdinand P. (U. S. Army Quartermasters Food and Container Institute for the Armed Forces, Chicago, Illinois)
Chemistry and Industry No. 2, 31-34 (January 10, 1959)

Introduction.--The total amount of frozen foods packed in the U. S. is estimated at 10 to 14 billion pounds annually. Vegetables average about 10 percent of total frozen-food sales. Frozen citrus concentrates average 5 to 6 percent of total sales. Precooked TV dinners and other precooked items average an additional 10 percent of total sales, and their volume is increasing continuously.

Technical terms.--Sharp freezing consists of placing products in the still air of cold rooms maintained at temperatures varying from +5° F. to -20° F. Quick freezing in its modern sense means solidification by freezing within a very short interval of time. Foods may be quick frozen (1) in pans floating on circulating brine, (2) on flat metal plates beneath which brine flows, or (3) between two moving or stationary cold plates. Air-blast freezers probably are the most common type of freezer in use today. In spray freezing, brine is directed in a fine spray either against the food itself or against the package. Products or packages also can be frozen by being submerged in brine or other refrigerating media.

Dehydrofreezing.--As the name implies, dehydrofreezing combines the processes of dehydration and freezing. The dehydration step removes most of the water--the actual amount varies with type of product--and thereby reduces volume and weight to a substantial degree. Only the "easily removed" water is separated in this drying step. "Hard to remove" water, which in traditional processes often is evaporated only at the risk of gross quality deterioration, remains in the product and is frozen in the succeeding step. Many dehydro-frozen foods occupy less than one-half of the packed volume of ordinary frozen foods. Shipping-weight reductions may amount to as much as 70 percent of the weight of similar, canned items.

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 ABSTRACTER: Martin Heerdt

3.2495 AGGREGATION OF COD MYOSIN DURING FROZEN STORAGE

Connell, J. J. (Torry Research Station, Aberdeen, Scotland)
Nature 183, 664-665 (March 7, 1959)

Introduction.--Monodisperse cod myosin has a pronounced tendency to aggregate when neutral solutions of it are left undisturbed at 0° C. The aggregation is characterized by the appearance in the ultracentrifuge picture of the solution of at least one, and sometimes two, discrete components that sediment faster than myosin and that, on the basis of their sedimentation coefficients, can be identified as a side-to-side dimer and trimer, respectively. It has now been found that this aggregation proceeds in the frozen state.

Experimental.--Solutions of monodisperse cod myosin (0.4 to 0.6 percent) in 0.45 μ potassium chloride with 0.05 μ phosphate buffer at a pH of 7.5 were placed in thin-walled plastic tubes measuring 5/8 inch by 2 inches; were frozen by immersion in a bath of chloroform and solid carbon dioxide at about -78° C.; were stored for 3 or 4 days at -7°, -14°, -22°, -29°, and -78° C.; and were thawed by placing the tubes in ice water at 0° C. Ultracentrifuge pictures were taken (1) of the original solution, (2) of the original solution after standing 3 days unfrozen at 0° C., and (3) of the solutions that had been frozen, stored, and thawed immediately after the thawing was completed.

Results.--Minimum aggregation occurred in the unfrozen solution held at 0° C. and in the solution held at -29° C. for 4 days. The amount of monomeric myosin in these solutions was so large that the top of the Schlieren peak was not registered and the typical bar effect parallel to the meniscus was produced. Maximum aggregation occurred in the solutions held at -14° and -22° C., and most of the myosin formed a heavy polydisperse material that sedimented to the bottom of the cell before the photographs were taken. Small residual amounts of monomeric and oligomeric myosin were left in the supernatant solution. At -7° and -78° C., aggregation proceeded to an intermediate stage. This result has been confirmed with two other preparations of cod myosin. Solutions held frozen

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 ABSTRACTER: Martin Heerdt

3.239 CHANGES DURING FREEZING AND THAWING OF FISH

Freixo, J.
Conservas de Peixe 13, No. 146, p. 27 (May 1958) (In Portuguese)
World Fisheries Abstracts 9, 31-32 (November-December 1958)

The changes undergone by fish during freezing and thawing are different.

1. Physical alterations.--These are controlled by the increase in volume, variation of consistency, change of color and loss of weight. When frozen, the volume of the fish increases from 5 to 6 percent. The change of color is noticed mainly in the eyes and gills which darken when the hemoglobin is oxidized into methemoglobin. To avoid this change, the fish should be opened and washed well before freezing. During air blast freezing part of the water and volatile aromatic substances contained in the cellular fluid are lost. This is avoided in part by glazing. During the thawing operation in open air, the fish lose part of the intracellular fluid, but this may be avoided in part by the use of quick-freezing and thawing in salt water.

2. Chemical alterations.--These are caused by atmosphere oxygen and autolysis. The oxygen acts on the fats making them rancid. Rancidity is a well known phenomenon, but investigations made so far lead to the following conclusions: (i) there is a certain relation between acidity and saponification taking place under the influence of certain enzymes; (ii) there is oxidation by the direct fixation of oxygen or hydroxyl groups by the molecule of fatty acids; (iii) there are changes in volatile products such as butyric esters, acids and aldehydes. Glycerin also has a role in the rancidity, but low temperatures delay this process. Glazing avoids oxidation of fat and the autolysis is caused by an enzyme not destroyed by low temperatures.

The technique for the determination of free amino acids followed by the Comissao Reguladora do

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 ABSTRACTER: Francisco Hoyos

3.332 EXPERIMENTS IN COOKING SARDINES--1

Meesemaecker, R. and Sohier, Y.
Food Manufacture 34, 148-153 (April 1, 1959)

Purpose.--Methods of cooking sardines (1) in water and brine and (2) in oil were investigated to determine the changes in weight that occur during cooking and the effect of these changes on the composition of cooked food.

Cooking in water and in brine.--Sardines were cooked in distilled water and in brine solutions of 15 percent and of 25 percent sodium chloride for 10, for 30, and for 50 minutes at about 225° F.

Results from cooking in water and in brine.--When the sardines were cooked in boiling water, the loss of weight increased from 13.3 percent in 10 minutes to 20.1 percent in 50 minutes; when cooked in a brine of 15 percent sodium chloride, the loss increased from 14.3 percent to 18.9 percent; and when cooked in a saturated brine, the loss increased from 15.1 percent to 18.7 percent. These apparent losses should be corrected by adding the quantities of salt absorbed by the fish during cooking.

One hundred grams of raw sardines that had been precooked in water for 10, for 30, and for 50 minutes, canned in oil, and heat processed yielded on examination of the opened cans 11.2, 6.6, and 6.7 grams, respectively, of exudate in the separated oil. Fish that have been precooked in water therefore should be dried before a covering of oil is added.

Analyses of fish cooked for 50 minutes showed the following results: (see below)

These and other analyses of the cooked fish obtained after varying the cooking time and the salt content of the brine confirm the dehydrating action of the sodium chloride.

Cooked in:	Water	Fat	Salt	Total
	Grams	Grams	Grams	Grams
Water	72.5	1.7	0.1	74.3
15-percent NaCl	67.0	1.1	5.9	74.0
25-percent NaCl	60.8	1.2	11.0	73.0

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 ABSTRACTER: June H. Olden

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Comercio de Bacalhau, Portugal, is also given. It is the Sorensen method and is as follows: 25 g. of fish are ground in a mortar for ½ hour with successive additions of small volumes of water until completing 125 cc. Add 25 cc. of 20 percent trichloroacetic acid and let the mixture stand for 5 to 10 min. Filter and take 10 ml.; neutralize with N/10 NaOH using phenolphthalein as an indicator and add 5 ml. of 40 percent formaldehyde solution previously neutralized. After obtaining an acid reaction, neutralize again with N/10 NaOH. The amino acids are obtained as N by multiplying the ml. of NaOH required to neutralize the acidity produced by the formol by 1.4 mg. The final result is expressed in mg./100 g. of product.

3. Histological alterations.--The internal injuries of frozen fish are caused by the ice crystals formed in the muscular tissue. The intracellular fluids pass into the solid state increasing their volume and distending the tissues, which lose their elasticity. The faster the freezing time the smaller the ice crystals. As a result, thawing in water has beneficial effect because the inhibition of water by the fish during thawing compensates up to a point the loss of liquid during freezing.

4. Microbiological alterations.--The number of bacteria does not increase during freezing. Only some fungi can grow on the frozen products but this happens very seldom on fish. To avoid this difficulty, temperatures below -8° C. (17.6° F.) should be used for storage. When freezing storage and thawing operations are well conducted, the nutritive value of fish decreases very little and the product will have the same taste and digestibility.

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Freeze dehydration is a process in which the product is frozen and then dried. The drying occurs by sublimation or lyophylization at freezing temperatures under high vacuum. Partial pressures in the drying chamber range from a few μ to a millimeter or so of mercury.

Economic trends.--The production and distribution of frozen foods is big business. Annual sales approximate $2.5 billion, and the rate of expansion suggests a doubling of this volume within 9 years. Refrigerated warehouses capable of supplying temperatures below 0° F. today have a capacity of approximately 400 million cubic feet and represent an initial investment of about $620 million. Frozen products are transported from processor to distributor to retailer in some 250,000 refrigeraged trucks and rail cars, which have an estimated value of approximately $1 billion. Retail stores that sell frozen foods in the United States have an estimated 350,000 units of refrigerated display cases. These cases represent an initial investment in excess of $350 million. In addition, $100 million is invested in backroom storage facilities.

The farmer who grows and who frequently delivers the produce receives approximately 18 cents from each frozen-food dollar spent by the homemaker. The processor who receives, grades, cleans, blanches, processes, packs, and stores the food for prolonged periods of time receives approximately 65 cents from each dollar spent for frozen foods. The wholesaler, distributor, and retailer jointly receive approximately 17 cents out of each dollar.

The frozen-food business is, for the most part, a business of mass sales and low mark-ups in all stages of the business. A distributor doing less than $1 million in gross business per year cannot survive unless he specializes only in a few items.

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During the retorting process, the sardine cooked in water or in brine loses a certain amount of water of composition, which takes with it a small fraction of the salt absorbed during cooking. In exchange, an appreciable quantity of covering oil penetrates into the tissue of the sardine. These exchanges with the surrounding medium involve large changes in the percentage composition of the sardine in oil, but the sum of the water, oil, and salt remains constant.

Conclusions from cooking in water and in brine.--The use of a saturated brine for cooking raw sardines apparently would result in a sardine (1) that is either insufficiently cooked or too salty and (2) that must be dried before being packed into cans.

The findings suggest that the following method of cooking might be satisfactory: (1) Pack the raw sardines into a can, which serves as a mold. (2) Cook in a dilute brine of such salt concentration that excessive saltiness of the fish is avoided whatever the time of cooking. (3) Remove the cans from the brine boiler and drain. (4) Expose the cans to hot air to evaporate the interstitial water retained by the cooked sardines. (5) Transfer the unit of fish to its final can, oil, seal, and sterilize. The quantity of exudate found in the oil separated from the sardines canned before and after drying will indicate (1) the time of cook required, (2) the efficacy of the drying, and (3) the necessity for any alteration in these operations.

Cooking in oil.--Losses from 100 grams of raw sardines cooked in oil are shown below:

	Temperature of cooking					
	212° F.			266° F.		
	5 min.	10 min.	15 min.	5 min.	10 min.	15 min.
	Grams	Grams	Grams	Grams	Grams	Grams
Loss on cooking	8.0	13.7	19.3	19.0	20.5	30.1
Frying oil absorbed	2.0	2.8	2.8	4.2	6.5	11.4
Exudate after sterilization	18.8	11.3	8.8	6.2	1.3	0
Total loss	28.8	27.8	30.9	29.4	28.3	41.5

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for about 7 days and then thawed, particularly those held at -14° and -22° C., often contain blobs of weak transparent gel and fine precipitates.

Two experiments with myosin frozen in solutions containing 0.45 μ sodium chloride and 0.45 μ potassium sulphate (both with 0.05 μ phosphate buffer, pH 7.5) showed that the pattern of aggregation is different from that occurring in solutions containing potassium chloride. In solutions containing 0.45 μ sodium chloride, aggregation is much the same at -7°, -14°, and -22° C.; whereas at -29° and -78° C., aggregation is less than it is at the higher temperatures. In solutions containing 0.45 μ potassium sulphate, aggregation that is pronounced at -7° C. becomes progressively smaller as the temperature decreases. These observations suggest that both the eutectic temperature of the solution--which was about -1.5°, -11°, and -21° C. for potassium sulphate, potassium chloride, and sodium chloride, respectively--and the temperature of storage are important factors in determining the rate of aggregation. A component that sediments more slowly than does myosin is formed during frozen storage and possibly also during equivalent periods of storage in the unfrozen state at 0° C. The largest amount of this presumed dissociation subunit of myosin appears to be formed at -78° C.

Discussion.--These complex changes appear to occur without any appreciable intramolecular change because the specific rotation and numbers of sulphydryl groups titratable with N-ethylmaleimide do not change during the first 7 days of storage at -7° C. Aggregation of cod myosin in the unfrozen state at 0° C. does not proceed by a conversion of sulphydryl groups into disulphide bridges for two reasons: (1) aggregation is not inhibited by the addition of 0.01 M monothiglycol and (2) treated myosin in which the reactive sulphydryl groups have been blocked by N-ethylmaleimide aggregates just as rapidly as does untreated myosin.

3.4 SMOKE CURING

Anonymous
Food Investigation 1957, Report of the Food Investigation Board (Great Britain), pp. 15-17 (1958) (London)

Physics.--A study of the basic factors involved in the deposition of wood smoke on surfaces has been continued. This is an essential prerequisite for the rational development of smoke-curing by new or improved procedures. A fluidized-sawdust-smoke procedure was used in this study to provide a constant and fairly reproducible supply of wood smoke. A new method based on equations already published was used to measure the average particle charge and the average particle radius of charged wood smoke. These were found to be about 20 electron units and about 0.1 μ, respectively. The average particle charge was dependent upon the particle radius and upon the conditions under which the particles are charged. The values for average particle radius and charge agree fairly well with those to be expected on the basis of measurement of optical density and mass concentration of the smoke and of the charging conditions.

Although the mass concentration of the particle phase of wood smoke appears to be much greater than that of the vapor phase, the contribution from the particle phase of the total amount of smoke deposited on wet surfaces is much less than that obtained from the vapor phase. The rate of deposition of wood smoke on water increases as the rate of evaporation of the water increases. Attempts are being made to determine the factors that simultaneously affect these two processes and to find the underlying reasons for the relationship.

Electrostatic smoking.--Full-scale studies of electrostatic smoking confirmed that the electrostatic equipment operates satisfactorily and with complete safety. During the initial period of operation, batches of kippers produced under controlled conditions by the electrostatic and by the normal

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 ABSTRACTER: Martin Heerdt

3.6 DRYING

Anonymous
Food Investigation 1957, Report of the Food Investigation Board (Great Britain), 19-20 (1958) (London)

"Browning" of dehydrated fish.--The brown or orange discolorations that often develop in dehydrated fish, particularly under high-temperature storage conditions, are a serious drawback to the commercial sale of this product. Similar reactions occur during the dry-salting of fish, particularly in the presence of metal catalysts.

Browning of freeze-dried extractives.--Freeze-dried extractives from fresh codling muscle exhibit a pattern of browning behavior that is affected by varying conditions of the relative humidity, temperature, and pH. This pattern differs considerably from that of typical sugar-protein reactions. The difference is based in part on the multiplicity of sugar-protein reactions that have not been demonstrated. These range from sugar-amine, sugar-amino acid, and sugar-phosphate reactions that may be catalyzed by metallic ions to varying degrees to the spontaneous degradation of some muscle-ring compounds such as 1-methylhistidine. Present indications are that the latter is likely to be a very important reaction. An attempt is being made to determine the amount of browning attributable to the various factors under different conditions.

Browning of free amino acids.--Individual free amino acids of codling muscle reacted with ribose in roughly stoichiometric proportions at 70-percent relative humidity, at 104° F., and at pH 6.8, which is the buffered post-rigor pH of trawled codling. After an initial lag period, most amino acids gave an exponential browning curve. Free amino acids in their ascending order of browning were valine, taurine, β-alanine, serine, lysine, and glutamic acid. The rate of browning paralleled the loss of sugar-amino acid from the reaction mixtures, but the amount of browning per mole of amino acid involved in the reaction varied with the specific amino acid. In the whole muscle, such

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 ABSTRACTER: Martin Heerdt

3.4 DRYING

Anonymous
Food Investigation 1957, Report of the Food Investigation Board (Great Britain), pp. 18-19 (1958) (London)

Introduction.--During the dehydration of fish, a falling-rate period of drying follows the initial constant-rate period of drying before diffusion limits evaporation. This falling-rate period has been found to consist of an initial phase of comparatively rapid drying and a final phase of very slow drying. The transition between the two phases appears to be associated with an uncovering of the unimolecular layer of water adsorbed on the surface of the protein molecules. The energy of activation for the diffusion of molecules of water is greater in the second phase than it is in the first phase.

Diffusion.--Brining does not alter the effective diffusion coefficient D_i during the first phase of the falling-rate period. During the second phase, however, the value of the coefficient D_{ii} is considerably reduced in relation to the value for unbrined fish. Furthermore, the free water content of brined fish is very much greater than that of unbrined fish when drying enters the second phase of the falling-rate period. These findings mark the beginning of a quantitative explanation of the unaccountably long period of time necessary to dry salt fish.

Vacuum freeze-drying.--A theoretical value of 1120 B.t.u. per pound has been established as the apparent latent heat of evaporation of water from frozen cod flesh during vacuum freeze-drying. If the water content of the muscle falls below about 15 percent of the weight of nonaqueous material, the water then remaining becomes increasingly difficult to remove. If the water content is less than 1 percent, the latent heat may exceed the theoretical value by a factor of 10. As in the case of diffusion, this transition appears to be associated with the uncovering of the unimolecular layer of water

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 ABSTRACTER: Martin Heerdt

4.60 AUTOXIDATION AND ANTIOXIDANTS

Bate-Smith, E. C. (Low Temperature Research Station, Cambridge, England)
Food Investigation 1957, Report of the Food Investigation Board (Great Britain), p. 42 (1958) (London)

Introduction.--Reactions between unsaturated fats and atmospheric oxygen--together with coupled oxidations of pigments, flavoring substances, and vitamins--can cause deterioration in the palatability, appearance, and nutritive value of a wide variety of foods. A method that often is valuable for controlling changes of this type is the addition of natural or synthetic antioxidants. These are substances that, at concentrations of the order of 0.01 percent, are able to inhibit the chain autoxidation of the fat molecules or to deactivate trace metal catalysts that act as prooxidants.

Purpose.--In a continuation of work in this field, the relation between structure and antioxidant activity of the tocopherols (vitamin E) is being examined. The tocopherols, which are widely distributed in the vegetable kingdom and pass to some extent into the body fats of animals, are probably the most important of the naturally occurring antioxidants of foods. All seven of the possible homologues of the series are now known.

Results.--A preliminary survey of the results obtained from tests in methyl linoleate or lard esters at 50° or 90° C. indicates that both the degree of nuclear methylation and the position of the methyl groups influence activity. A tendency exists for potency to decrease (1) in the order monomethyl, dimethyl, and trimethyl and (2) in the order 8-methyl, 7-methyl, and 5-methyl. This work is being carried out in collaboration with the Dunn Nutritional Laboratory, Cambridge.

Several of the polyphenols, which are major constituents of the phenol fractions of green and black tea, have been shown to possess marked antioxidant properties.

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 ABSTRACTER: Martin Heerdt

3.4

adsorbed onto the surfaces of the protein molecules.

Cod steaks dry more rapidly than do cod fillets, apparently because the thermal conductivity of the muscle is greater along the direction of the muscle fibers than across them. For this reason, the undried portion within the steaks receives heat at a higher rate than does that portion within the fillets. Since the rate of drying depends entirely on the rate of heat transfer across the dried muscle, steaks dry more quickly. The rate of heat transfer, however, is limited by the scorching that results when the surface temperature exceeds 158° F. This scorching occurs regardless of the method of heating that is employed. In practice, steaks 0.59 inches thick--heated from one side only--cannot be dried in less than about 14 hours. Little advantage is to be expected from the use of infrared radiation, owing to low heat transmission by the dried muscle. Salt fish, which may take from 1 to 6 weeks to dry by traditional methods, have been dried in the small freeze-drying plant in 7 hours.

Storage tests with nitrogen-packed freeze-dried fillets show that a slow deterioration in texture and taste occurs over a period of 8 months in samples stored at 32° F. and 64.4° F., but the quality of both groups is acceptable at the end of this period. Samples stored at 97.7° F. rapidly become tough, brown in color, objectionable to taste, and clearly unacceptable.

Texture of dehydrated fish. --Two important factors that affect the texture of a fibrous foodstuff such as fish are (1) whether the individual fiber bundles in the flesh are compressed or held loosely together and (2) what the condition is of the fibrous protein substance itself.

Dehydrated fish toughens during storage, owing to chemical and physical changes in the fiber protein. Evidence has been obtained to show that this change involves a cross-linking of the fiber protein molecules. For example, extensibility, degree of swelling, water-holding capacity, and solubility of the fiber all decrease during storage. In polymer gel systems, these changes are indicative of the formation of cross-links. X-ray pictures show that β-protein, which is the stretched or denatured form of α-protein, is less extensible than is α-protein; this finding therefore is significant.

4.60

Investigations of the chemical nutritional changes that occur in stored fish meal as a result of oxidative changes in the oil, and of their possible control by the use of antioxidants, are in progress in collaboration with the University School of Agriculture. Although essentially an animal feed, fish meal is valuable both as an experimental material and as an industrially important commodity in its own right. Fish meal, in comparison with other human foods, may display lipid-protein interactions. Preliminary results on the protective effect of antioxidants are promising. Chicks used in this study have shown a high degree of tolerance for stored meal containing highly oxidized and polymerized oil.

3.4

methods were obtained for cold-storage experiments. The quality of herring obtained was poor, owing to the scarcity of supplies. Storage experiments are in progress.

Smoke production. --A fluidized-smoke-sawdust producer has been developed to provide an accurately controllable source of smoke (a) for use with the Torry kiln and (b) for use in physical and chemical studies of wood smoke.

This smoke producer, which operates by the maintenance of a fluidized bed of sawdust in a stream of hot air, was first tried on a commercial scale in 1956. This work showed a need for a more efficient air heater and for improved methods of maintaining the stability of the fluidized bed. Both the air heater and the reactor now have been entirely redesigned. As a result, the fluidizer now warms up to working temperature more quickly, uses less electric power when running, and gives more smoke for its size. A large Torry kiln of modern design is being used in these trials. No difficulty has been encountered in maintaining the required smoke densities.

Chemistry of wood smoke. -- The antioxidant properties of wood-smoke fractions have been studied with the aid of a model testing system similar to the biological catalyst systems used with herring. The system used in this study is based on the hematin-catalyzed auto-oxidation of suspensions of methyl linoleate. With smoke deposited in the traditional manner, almost all of the antioxidant activity was found in the smoke fractions that contained the volatile phenols: 1:3-dimethylpyrogallol, guaiacol, creosol, and 2-methoxy-4-ethylphenol. Estimations of the individual components and studies made with model solutions of these antioxidants showed that these compounds are responsible for the antioxidant activity of wood smoke. Creosol provided the largest single amount of antioxidant activity.

Electrostatically deposited smoke was found to contain smaller amounts of the volatile phenolic antioxidants and very much larger amounts of the nonvolatile phenols, such as hydroquinone, catechol, and 4-methyl-catechol. The antioxidant activity of this smoke was divided between the two classes of phenols. The antioxidant activity of wood-smoke deposits probably is controlled by the relative contributions of the particle and vapor phases to the smoking process.

3.6 (Cross Reference: 0.33)

reactions would be buffered by protein, phosphates, and other compounds except under conditions of dehydration where occasionally during the vacuum contact drying process, syneresis results in an independent browning of the extractives.

In experiments similar to those outlined above, but buffered with phosphate at pH 6.8, the rate of ribose disappearance invariably was greater than that of the amino acid, and the order of browning of the amino acids was: leucine, valine, aspartic acid, α-alanine, glycine, serine, β-alanine, taurine, lysine, and glutamic acid. Ribose disappeared slowly in the absence of amino acid under these conditions. This disappearance arose in part from isomerization and was not accompanied by much pigmentation. Although conditions are not ideal for the study of model sugar-amino reaction systems, they are not markedly different from the conditions that prevail in dehydrated muscle. These studies indicate that the browning reaction is more complicated than it first appeared to be. The chromatography of reaction mixtures between individual amino acids and sugars has indicated the formation of a multiplicity of compounds, many of which arise from reactions with isomers of ribose.

4.3 LIQUID/SOLID CONTENT OF FATS

Chapman, D. (Research Department, Unilever, Ltd., Port Sunlight); Richards, R. E. and Yorke, R. W. (Physical Chemistry Laboratory, Oxford, England)
Nature 183, 44 (January 3, 1959)

The consistency of margarine and other commercial fats depends to a large extent on the relative amounts of liquid and solid fats present. The usual method for determining these values is by dilatation measurements and the dilatometer is used fairly considerably for this work. There are, however, certain inherent errors in this type of measurement. It is stated that the calculation of liquid/solid content from dilatometric data is either not possible with any degree of accuracy or even that it is impossible with complex mixtures of glycerides. This arises from the fact that a prior knowledge of the glycerides present is required and that mathematical adjustment is needed to take account of the different melting dilatations. Such prior knowledge is not always available.

We have recently found that the use of low-resolution nuclear magnetic resonance spectroscopy provides a new means for such determinations which eliminates many of the inherent errors of the dilatation method. In effect, use is made of the inherent disparity in the nuclear magnetic line-widths observed with liquids and solids. It is known that the shape of the hydrogen resonance line is influenced by the chemical and physical state of the sample and that the width is related to the mobility of the compound containing the hydrogen and to the field homogeneity. With solids the line-width is of the order of several gauss, while with liquids the line-widths is very narrow and is determined by the inhomogeneity of the applied magnetic field.

An example of the method adopted is illustrated by the determination of the liquid content of simple mixtures of known amounts of tristearin and triolein (tristearin does not form a solid solution in the triolein phase). A bridged-T nuclear magnetic resonance spectrometer was used. The magnetic

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4.91 THE EFFECT OF CONCENTRATES OF POLYUNSATURATED ACIDS FROM TUNA OIL UPON ESSENTIAL FATTY ACID DEFICIENCY

Privett, Orville S.; Aaes-Jørgensen, Erik; Holman, Ralph T.; and Lundberg, Walter O. (Hormel Institute, University of Minnesota, Austin)
Journal of Nutrition 67, 423-432 (March 10, 1959)

Introduction.--Only those acids that have a terminal structure similar to that of linoleic acid have been found thus far to exhibit all of the activities of an essential fatty acid (EFA). Whether fish or marine oils contain sufficient acids of the linoleic acid type to meet the needs for essential fatty acids is not known; therefore, the authors decided to test a typical marine oil for its EFA activity. To obtain more precise information, they tested the individual chain-length fractions from tuna oil unsaturated methyl esters on rats for their effects upon growth, dermal symptoms, and polyunsaturated acid contents of representative tissues.

Materials.--Tuna oil was saponified, and the unsaponifiable matter was removed by extraction of the soaps. The fatty acids were liberated with acid, and the free acids were subjected to a scheme of low temperature crystallization in light petroleum ether. The fraction that was soluble at -70° C. in a 10 to 1 ratio of solvent to solute was recovered and fractionated further by urea crystallization. Most of the less unsaturated acids formed urea-inclusion compounds at -15° C., and the highly unsaturated acids, which comprised the bulk of the sample, remained in the filtrate. This fraction was esterified with methanol and then was fractionated according to chain length by distillation in a Podbielniak whirling band column. The four fractions fed to rats in this study represent concentrates of the highly unsaturated acids from tuna oil. They do not represent the total fatty acids of tuna oil fractionated according to chain length. The C_{22} fraction, which represents a high concentrate of methyl docosahexaenoate, had only one unsaturated component detectable by the paper chromatography,

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ABSTRACTER: Martin Heerdt

6.1 MARINE PRODUCTS - PART II.

Anonymous
The Feed Bag (Buyers' Guide of 1959), pp. 78-80 (1959)

Fish products other than fish meals used in the manufacture of commercial feeds include (1) condensed fish solubles, (2) dried fish solubles precipitate, (3) homogenized condensed fish, (4) fish bone-meal, and (5) kelp meal.

Condensed fish solubles.--Condensed fish solubles is obtained by condensing the aqueous portion of the mixture that results from pressing and separating the oil from fish. It is variable in composition and especially valuable in supplementing poultry rations that have a high soybean and corn content. Condensed fish solubles move, in commerce, in a semisolid or condensed form. They are usually mixed with alfalfa-leaf meal, fish meal, kelp, or other materials to produce vitamin supplements. Condensed fish solubles contain approximately 35 percent protein, 3 percent fat, 0.1 percent calcium, and .80 percent phosphorus. The ash content depends upon the sodium chloride (salt) content. Condensed fish solubles are valued primarily for their vitamins. In addition to valuable unidentified growth factors, the product contains approximately 3.2 milligrams (mg.) of thiamine, 6 mg. of riboflavin, 130 mg. of niacin, 18 mg. of pantothenic acid, and 1400 mg. of choline per pound.

Dried fish solubles precipitate.--Fish solubles are sometimes treated with acid to precipitate the acid coagulable protein. The result is a precipitate of dried fish solubles or the dried and ground precipitate obtained by adjusting the raw, press water containing fish solubles to approximately pH 4.5.

Homogenized condensed fish.--A new product that has a texture similar to condensed fish

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ABSTRACTER: Martin Heerdt

6.10 MARINE PRODUCTS - PART I.

Anonymous
The Feed Bag (Buyers' Guide of 1959), pp. 76-78 (1959)

Official definitions.--Fish meal is clean, dried, ground tissues of undecomposed whole fish or fish cuttings, either or both, with or without the extraction of part of the oil. If more than 3 percent of sodium chloride (salt) is present, the amount of salt must appear as a part of the brand name. The salt content of fish meal cannot exceed 7 percent.

Fish-residue meal is the clean, undecomposed residue from the manufacture of glue from nonoily fish. If more than 3 percent of salt is present, the amount of salt must appear as a part of the brand name; the salt content cannot exceed 7 percent.

Commonly used fish meals.--Menhaden meal is made from the residue that remains after most of the oil has been extracted from the fish. The meal may be dried indirectly with steam heat at atmospheric pressure or under vacuum. Some menhaden meal is dried by direct heat in a flame dryer. Menhaden meal contains 58 to 60 percent protein, 6 to 10 percent fat, less than 1 percent fiber, about 20 percent ash, 4 to 6 percent nitrogen-free extract, 6.5 to 8 percent calcium, and 3.5 to 4 percent phosphorus. One pound of menhaden meal contains about 2.4 milligrams (mg.) of riboflavin, 4.2 mg. of pantothenic acid, 25.9 mg. of niacin, and considerable vitamin B_{12}.

Sardine meal or pilchard meal is produced principally on the West Coast from sardine canning waste and from whole sardines. It is dried indirectly with steam heat at atmospheric pressure or under vacuum. A small amount is flame dried. Sardine meal is a high grade product, and a large amount of it is marketed on the East Coast. Sardine meal contains from 60 to 70 percent protein,

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ABSTRACTER: Martin Heerdt

LIQUID/SOLID RATIO IN FATS

UNSATURATED ACIDS IN NUTRITION

FISH PRODUCTS OTHER THAN MEAL

FISH MEALS IN COMMON USE

4.91

even though its iodine value of 414 was less than the theoretical value of 445. The ultraviolet absorption spectra obtained after alkaline isomerization of the four fractions indicated that the most highly unsaturated components were tetraene for C_{16}, tetraene for C_{18}, pentaene for C_{20}, and hexaene for C_{22}. The hexaenoic acid present in the C_{22} portion was found to be 4, 7, 10, 13, 16, 19-docosahexaenoic acid by the method of Von Rudloff (1956).

Experimental. -- A fat-free diet was fed ad libitum to 48 male weanling rats of the Sprague-Dawley strain. The diet consisted of 16 percent vitamin-test casein, 4 percent α-cellulose, 74 percent sucrose, 4 percent Wesson salt mixture (1932), 1 percent of a mixture of vitamins in casein, and 1 percent of a mixture of choline chloride in casein (Aaes-Jørgensen and Holman, 1958). After 11 weeks, the growth rate had become rather slow, and distinct dermal symptoms of essential fatty acid deficiency had appeared in all animals. The rats then were divided into six equal groups and continued on the same fat-free diet during the period of supplementation. Groups 1 to 6, respectively, received no supplement; ethyl linoleate; and the C_{16}, C_{18}, C_{20}, and C_{22} fractions of highly unsaturated acids from tuna oil. All supplements were administered in doses of 200 milligrams (mg.) thrice weekly. Rats were weighed and inspected each week. After 6 weeks of supplementation, the rats were killed by ether anaesthesia, and their hearts and testes were taken for analysis. The polyunsaturated acid content was determined by the method of Holman and Hayes (1958).

Results. --None of the fractions that contained fatty acids with 16, 18, 20, or 22 carbon atoms relieved the dermal symptoms of the EFA deficiency. However, all of the fractions except the 16-carbon fraction allowed the deposition of abnormally high amounts of trienoic acid in heart and testis tissue.

4.3

field was modulated at a sinusoidal frequency of about 40 c./s. with a magnitude of about 30 milligauss, peak to peak. The line-width was determined by the inhomogeneity of the magnetic field and was about 100 milligauss at half-height. Under these conditions the derivative curve shows no signal due to the broad band of the solid, and a measure of the peak-to-peak height of the recorded derivative curve is a direct measure of the amount of liquid present. By comparing the peak-height for any of the mixtures with that for 100 percent liquid, the liquid content can therefore be determined. Typical results are shown in table 1 (see below). Similar work has also been carried out with other fat mixtures.

The new technique has the following advantages: (a) Fats or mixtures may be examined in the state in which they are received; that is, without altering the structure by melting or crystallization. (b) The results are independent of the particular composition of the fat; that is, no prior knowledge of the glycerides present is required. (c) The results are independent of the polymorphic form of the solid present.

A full account of this work will be reported elsewhere.

Table I.

Known percentage of liquid glyceride	Average percentage found
75.1	74.0
50.2	51.2
25.1	25.4

6.10

6 to 9 percent fat, less than 0.5 percent fiber, 14 to 16 percent ash, 2 to 5 percent nitrogen-free extract, 6 percent calcium, and 3 percent phosphorus. One pound of sardine meal contains approximately 2.9 mg. of riboflavin, 1.3 mg. of pantothenic acid, 1700 mg. of choline, 26 mg. of niacin, and considerable vitamin B_{12}.

Herring meal, which is produced in quantity in Alaska and in the Pacific Northwest, contains about 70 percent protein. Herring meal is used in high-grade feeds made in the Pacific Northwest.

Salmon meal is made as a byproduct of the salmon canning industry in the Pacific Northwest and in Alaska. It usually is a high-grade product that has a good market value. Most of it is used near producing centers.

White fish meal is principally made on the North Atlantic Coast and is the byproduct from the processing of cod and haddock for human food. White fish meal contains approximately 63 percent protein of very good quality, 3 to 8 percent fat, about 0.5 percent fiber, and 18 to 26 percent ash.

Crab meal, which is the undecomposed, ground, dried waste of the crab, contains the shell, viscera, and part or all of the flesh. If more than 3 percent of salt is present, the amount of salt must appear as a part of the brand name. Crab meal contains approximately 31 percent protein, 1.5 percent fat, 13 percent fiber, 43 percent ash, 4 percent nitrogen-free extract, 14 percent calcium, and 1½ percent phosphorus. Crab meal is used in poultry mash feeds.

Shrimp meal, which is made in the South along the Gulf of Mexico, is the undecomposed, ground, dried waste of shrimp. It is made from either the head and the hulls or the head and the whole shrimp or from a mixture of these parts. If more than 3 percent of salt is present, the amount must appear as a part of the brand name. Shrimp meal cannot contain more than 7 percent salt. Shrimp meal, which is also called shrimp bran, contains about 40 percent protein, 2 percent fat, 9 percent fiber, 34 percent ash, and 1 percent nitrogen-free extract. It is used to some extent in hog feeds and to a slight extent in poultry feeds. Steam-dried shrimp meal is better than sun-dried shrimp meal as an ingredient in poultry feeds.

6.1

solubles is being produced by the treatment of whole fish or fish offal with acid. The analysis of this product varies according to the raw material used. Tentatively, the definition of homogenized condensed fish is a partially dehydrated product made from fish and fish cuttings from which a part of the oil may have been removed. The product contains not less than 50 percent total solids, exclusive of salt. If more than 3 percent of sodium chloride (salt) is present, the amount of salt must appear as a part of the brand name. In no case shall the salt content exceed 7 percent.

Fish bone-meal. --Fish bone-meal--another new product--is the dried, ground product obtained by separating the bones from the whole fish or fish cuttings. It contains not less than 8.5 percent phosphorus and is labelled to include a guaranteed analysis for protein, calcium, and phosphorus.

Kelp meal. -- Kelp meal, a marine product used largely as a source of mineral matter, consists of the ground, dried, ocean seaweed known as kelp. It contains about 5.5 percent protein, 0.75 percent fat, 7.5 percent fiber, 33 percent ash, and 44 percent nitrogen-free extract. The ash contains appreciable amounts of sodium and potassium chlorides, and many of the "trace" elements are present in small amount. It is particularly valued for use in feeds because it contains about 0.2 percent natural iodine.

6.132 ENZYMES PROCESS FISH

Anonymous
Chemical and Engineering News 37, 27 (April 13, 1959)

Introduction.--Cleaner fish-derived animal feeds and lower cleaning costs on food fish may be ahead, thanks to enzymes. W. W. Meinke of the Texas Engineering Experiment Station disclosed details of a process that uses enzymes to digest viscera and connecting tissues and to loosen body scales. In some ways, the process is similar to tenderizing meat with enzymes.

Although research into the use of enzymes for processing trash fish has been under way 2 years, positive results now show its potential for making animal feeds. For possible food uses, the process will have to be tailored to each fish species considered. Initially, some edible fish have been found to resist enzyme action. Other enzymes not yet tested, however, may overcome this resistance.

Meinke and coworkers at TEES chemurgic research laboratory have processed quantities of golden croaker, sand trout, mullet, and other fish. More work is needed however to prove the enzyme process in preparing fish for canning. Mullet, particularly in small sizes, is considered a trash fish. A significant amount of the fish that is caught and discarded along the Gulf Coast is mullet.

Economics.--Meinke evaluated economics in processing mullet and finds a good potential net profit. A ton of mullet that has been processed and deheaded leaves 850 pounds of carcasses. Solubles from the digestion liquor give 316 pounds more per ton. Bones and scale yield 157 pounds, and oil averages about 30 pounds.

Assuming a value of $140 per ton for fish meal, $60 a ton for bone meal, and $200 a ton for fish oil, and taking into account moisture content--which may range to 75 percent for carcasses--Meinke comes up with a value of more than $43 per ton of mullet processed. Processing cost runs just under

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7.53 F. I. R. I. RAPID FAT DETERMINATION

Dreosti, G. M.; van der Merwe, R. P.; and Stander, G. H.
Annual Report, Fishing Industry Research Institute, April-December 1956, Cape Town, South Africa, 10, 31-32 (1957)

Purpose.--The refractometric method of determining fat in fish meal was re-examined to ascertain whether it could be adapted to whole meal and to recheck whether the exact temperature of extraction, above 80° C., was important. The present analyses were carried out at Cape Town and at the Walvis Bay Station.

Findings at Walvis Bay on samples of meal of various degrees of fullness.--The monochlornaphthalene method, both at 80° C. and at 100° C., gave better reproducibility of results than did the soxhlet method. With monochlornaphthalene, duplicates agreed on an average to within 0.10 percent, the biggest difference being ± 0.3 percent. The corresponding values for soxhlet fats were 0.25 percent and ± 0.5 percent.

With the monochlornaphthalene method, the values obtained at 80° C. and at 100° C. agreed closely; that is, to within 0.1 percent on an average and to within 0.6 percent in all cases.

The values also agreed well with the hexane values; that is, to within 0.5 percent on an average and to within 0.6 percent in all cases with the exception of five meals that did not follow the above pattern at all. These samples gave about the same results when analyzed by monochlornaphthalene at 80° C. and at 100° C., but the values in each case were about 1.5 percent higher than those obtained by soxhlet extraction with hexane.

Findings at Cape Town on samples of whole meal.--Results at Cape Town indicated an average difference of 0.9 percent between 100° C. and 80° C. extraction. Agreement of 80° C. figures with

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ABSTRACTER: June H. Olden

7.51 RE-CHECK OF F. I. R. I.'S RAPID PROTEIN METHOD

Stander, G. H.
Annual Report, Fishing Industry Research Institute, April-December 1956, Cape Town, South Africa, 10, 33-34 (1957)

Purpose.--Tests in connection with digestion time, catalysis, and frothing were performed to check the rapid method used by F.I.R.I. for protein determination.

Digestion time.--When identical samples of fish meal were digested for 30 minutes and for 45 minutes, the 30-minute values were, on an average, 0.1 percent higher than the 45-minute values. These findings indicated a possible loss of nitrogen on prolonged heating. Next, identical samples were digested for 30 minutes and for 90 minutes, the rapid method being used. For both full and ordinary meal, the 90-minute values were an average of 1.1 percent lower than the 30-minute values. In the F.I.R.I. rapid method, a temperature of 395° C. is attained after digestion for 15 minutes. It may be assumed that a temperature of 412° C. may be exceeded during a 90-minute digestion period, caused by loss of acid during boiling. This would then result in a loss of nitrogen, as was found in the above tests.

Mechanical loss.--Mechanical loss seemed to be possible because of the extremely rapid digestion, and consequent excessive frothing, during the early stages of digestion. To prevent frothing, the author heated a series of samples gently for 15 minutes and then vigorously for an additional 20 minutes. Comparison of the values obtained for these samples with figures obtained for identical samples heated vigorously for 20 minutes and for 30 minutes resulted in findings that (1) 20 minutes of digestion is inadequate, (2) gentle heating during the initial stages of digestion did not give higher results, and (3) there appeared to be no mechanical loss during rapid digestion.

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ABSTRACTER: June H. Olden

7.80 INDUSTRY RACES TO FRAME FF CODE AHEAD OF STATES

Anonymous
Quick Frozen Foods 21, 33-35 (April 1959)

The frozen food industry of the United States is interested in aiding the Association of Food and Drug Officials of the United States to formulate and promulgate a set of regulations for the handling of frozen foods. The urgency is caused by the fact that a stringent, realistic, but workable national code would probably prevent individual state governments from devising their own laws concerning the handling of frozen foods. Fifty different handling codes would cause almost insurmountable problems for the industry.

At least four states are known to have prepared tentative regulations that they are trying to get through their state legislature or are holding until they see the results of the work of the Association of Food and Drug Officials.

At the 18th Annual Convention of the National Association of Frozen Food Packers in Chicago, a large proportion of the sessions were devoted to presenting initial drafts of handling codes on frozen foods for each phase of the industry. Some codes are virtually complete, whereas others may take a year or more to complete because both scientific research and opinion by industry are necessary before a decision can be made.

A typical problem requiring laboratory work before an answer can be arrived at is to determine the quantity of bacteria that is considered unsafe in a long list of prepared frozen foods, particularly gravies.

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ABSTRACTER: Kathryn L. Osterhaug

ENZYME DIGESTION OF FISH

RAPID PROTEIN DETERMINATION

RAPID FAT DETERMINATION

NATIONAL FROZEN FOOD CODE

7.51

Full versus ordinary meals.--Full and ordinary meals were digested to establish whether or not the rapid method, with H_gO as catalyst, gave complete digestion for both full and ordinary meals; the old method, with $CuSO_4$ as catalyst, was used as a basis for the evaluation of the results. For both full and ordinary meals, the rapid method (30 minutes) resulted in values that were an average of only 0.1 percent lower than those of the old method (3 hours). Thus, there is no indication that the rapid method tends to give low values for full meals.

Summary.--(1) With the use of F.I.R.I.'s rapid method, complete recovery of nitrogen is obtained for both full and ordinary meals. (2) Prolonged digestion gives rise to loss of nitrogen. (3) No evidence of mechanical loss was found.

7.80

The Frozen Foods Committee of the National Food Brokers Association has prepared a booklet entitled NFBA Covers the Cold Front. The NFBA says:

"Quality frozen foods can become second-or-third rate merchandise if they are not kept at proper temperature all along the line of delivery to the consumer. Vigilance is necessary from the production point down through transportation, cold storage handling and customer handling, to delivery to retail stores or to institutional users. Products of poor quality--whether from a production standpoint or from mishandling--will not help either packer who produces them or the broker who arranges for their sale."

6.132 (Cross Reference: 6.55)

$10 per ton, including enzymes, steam, water, and patent royalties. Cost was $20 per ton for mullet.

Experimental.--Meinke tested bacterial, vegetable, and animal proteolytic enzymes to process fish. Of these groups, bacterial enzymes give best over-all results, but since the work is still exploratory, many details of the enzyme action, its selectivity, and its control remain unknown.

Enzyme action is known to begin on all parts of a fish when it is placed in a tank containing an enzyme solution. Action continues, although it is slowed, after washing the carcass. Heat is needed to kill the enzymes, and final drying takes care of this.

7.53

the hexane values again was within 0.5 percent on an average and most were within 0.6 percent in individual cases.

Summary.--(1) The refractometric method is applicable to full meals as well as to ordinary meals. (2) Extraction at 100° C. gives results that are usually only slightly higher than those at 80° C.; that is, less than 0.25 percent on an average, with some values up to 1 percent higher. (3) Extraction at 80° C. is preferable to extraction at 100° C.; and values obtained at this temperature, although usually higher than hexane values, agree to well within 0.4 percent with them on an average. High values were occasionally obtained by this method, however, some of them being up to 1.6 percent too high. (4) The refractometric method gives better reproducibility of results than does the hexane-extraction method.

7.89 A SIMPLE METHOD OF CHECKING ON THE SOURCES OF CONTAMINATION IN FISH PLANTS

Castell, C. H.
Canadian Fisherman 46, 14-15 (January 1959)

The following are needed in order to check for sources of contamination in fish plants, (a) one intelligent man, preferably a foreman or one of the cutting-room supervisors, (b) one good, sharp knife for cutting and skinning fillets, (c) 20 or 30 fresh small haddock or scrod cod, (d) a pail of disinfectant solution--preferably a hypochlorite solution containing about 500 to 1000 parts per million (p. p. m.) available chlorine, (e) a good-sized pair of tweezers, (f) 40 or 60 waxed cardboard containers, each one large enough to hold one fillet.

How to do it.--1. Thoroughly wash the gutted fish and dip them in a chlorine solution containing 50 or 100 p. p. m. available chlorine.

2. From these fish, cut fillets with the utmost care to keep bacterial contamination down to a minimum.

3. Place the fillets in the waxed cardboard containers. Label the two containers holding each of the first pair of fillets No. 1A and No. 1B; the containers for the second pair, No. 2A and No. 2B. Continue in this manner until each fish is in an individual container and the fillets arranged in pairs of A's and B's. The "A" fillets will be used to detect the sources of contamination. The "B" fillets are controls.

4. Start at the wrapping table and work backward through the plant until you reach the cutting tables. With the tweezers pick up the fillet from container No. 1A and drop it on the packing table, or the tray used on the packing table. Count to 10 and then, with the tweezers, turn the fillet over. Count to 10 again and with the tweezers put the fillet back in its container and close the lid. Follow this same procedure, using a different "A" fillet each time, for touching both sides of the fillet to some surface that the ordinary fillets passing through the plant come in contact with.

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ABSTRACTER: Kathryn L. Osterhaug

8.610 VITAMIN A_1 ALDEHYDE IN THE EGGS OF THE HERRING (CLUPEA HARENGUS L.) AND OTHER MARINE TELEOSTS

Plack, P. A.; Kon, S. K.; and Thompson, S. Y. (University of Reading, England)
The Biochemical Journal 71, 467-476 (March 1959)

Introduction.--Studies on the vitamin A content of herring revealed only about 0.1 μg. per gram of vitamin A and about 1.0 μg. per gram of carotenoids, mostly xanthophylls. In these studies, vitamin A ester, vitamin A alcohol, and carotenoids were estimated in the ovaries of herring of various ages and maturities by the method of Thompson, Ganguly, and Kon (1949) and Fisher, Kon, and Thompson (1952). This method involves extraction with light petroleum in the presence of ethanol, chromatography, saponification, and measurement of vitamin A by the Carr-Price test. Subsequently, the authors carried out biological and chemical assays of the vitamin A activity of additional samples of unfertilized eggs from ripe and running fish and found that the biological activity, as determined by the chick liver-storage method, was about ten times the chemical activity.

Purpose.--This study was made to investigate a discrepancy that proved to be caused by the presence of vitamin A_1 aldehyde in the eggs, which was not measured by the routine chemical method.

Experimental.--Quick-frozen herring that had been caught off East Anglia in the autumn fishery when they were ripe and running were purchased from a Reading fishmonger. They were thawed by immersing them in warm water and sexed by squeezing the fish. Males and immature females were discarded. The roe were removed from the remaining females through a ventral cut. Care was taken to exclude portions of the intestine or other organs. Five-gram portions of herring eggs were homogenized for 2 minutes with 7.5 milliliters (ml.) of ice-cold 0.9-percent NaCl solution in a glass Potter-Elvehjem homogenizer previously cooled to 0° C. For feeding studies, the supernatant liquid and the solid residue were separated by centrifuging for 45 minutes at 20,000 times gravity. For

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ABSTRACTER: Martin Heerdt

8.0 PROXIMATE COMPOSITION OF GULF OF MEXICO INDUSTRIAL FISH PART 1 AND PART 2

Thompson, Mary H. (Bureau of Commercial Fisheries, Pascagoula, Mississippi)
Commercial Fisheries Review 21, 17-23 (February 1959-Supplement)

The protein, oil, ash, and moisture content of 11 species of industrial fish that commonly are taken during the winter and spring in the Gulf of Mexico are reported by the author.

Table 2.--Proximate composition of industrial fish commonly caught in the winter

Common name	Scientific name	No. of fish in each sample	Protein average %	Oil average %	Ash average %	Moisture average %
Anchovies	Anchoa sp.	72-93	16.4	3.5	3.45	75.9
Anchovies	Anchoa hepsetus	12-13	17.3	2.6	3.53	75.7
Butterfish	Poronotus triacanthus	2	15.1	2.2	2.82	79.3
Croaker	Micropogon undulatus	2	15.2	2.2	5.98	77.2
Razorbellies	Harengula pensacolae	6	18.9	7.7	7.1	67.1
Round herring	Etrumeus teres	3	18.9	2.5	3.82	73.8
Silver eels (Cutlassfish)	Trichiurus lepturus	4	18.1	4.3	2.96	75.4
Silversides	Menidia sp.	26-28	17.4	5.9	8.23	67.5
Spots	Leiostomus xanthurus	2	14.1	5.5	4.09	76.5
Thread herring	Opisthonema oglinum	4	18.9	8.1	3.24	69.3

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ABSTRACTER: Kathryn L. Osterhaug

9.15 DRY DIETS FOR CHINOOK SALMON

Nielson, Walter E. and Mazuranich, John J. (Bureau of Sport Fisheries and Wildlife, Western Fish Disease Laboratory, Seattle, Washington)
Progressive Fish-Culturist 21, 86-88 (April 1959)

Seven different starting diets were used for chinook salmon fry. The diets for the seven lots of fish were as follows: lot 1--40 percent beef liver and 60 percent fish meal; lot 2--40 percent beef liver and 60 percent shrimp meal; lot 3--50 percent fish meal and 50 percent shrimp meal; lot 4--100 percent X, a commercial fry feed (pelleted); lot 5--100 percent Y, a commercial fry feed (pelleted); lot 6--100 percent Z, a commercial fry feed (pelleted); and lot 7--100 percent fish meal.

Experimental procedure.--One thousand chinook salmon fry were counted by hand into each of seven troughs. The initial average weight of each fish was obtained by weighing 100 fish from each of the troughs. The initial average length of the fish was obtained by drawing 50 fish through a glass tube and measuring them with dividers.

During the 10 weeks of feeding, water at a temperature of 52° to 53° F. flowed through the troughs at a rate of 1.75 gallons per minute, which amounted to 2.3 water changes each hour.

The fish were fed eight times a day during the first week of feeding. With the start of the second week, the number of feedings for lots 1, 2, 3, and 7 was reduced to four a day because these fish did not appear to be getting enough feed per feeding. Lots 3, 5, and 6 were fed the commercially prepared diets eight times a day throughout the 10 weeks of feeding. Each of the lots was fed approximately 2 percent of the body weight of the fish in lot 1 per day. A 2-day supply of feed was weighed on a gram scale for each lot and kept in a refrigerator until used. Each of the lots was weighed and measured every 2 weeks. The amount of feed was increased every other day for the first 2 weeks and then was increased on the average of once a week as needed to coincide with the weight of the control lot of fish.

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ABSTRACTER: Kathryn L. Osterhaug

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Table 2.--Proximate composition of industrial fish commonly obtained in the summer

Common name	Scientific name	No. of fish in each sample	Protein average %	Oil average %	Ash average %	Moisture average %
Anchovies	Anchoa hepsetus	14-16	17.2	2.6	3.29	77.3
Bumper	Chloroscombrus chrysurus	2	18.7	6.0	4.22	71.3
Butterfish	Poronotus triacanthus	2-4	15.6	6.2	2.36	76.0
Croaker (June)	Micropogon undulatus	2	15.9	8.6	4.85	69.9
Croaker (July)	Micropogon undulatus	2	16.7	3.6	3.05	76.0
Hardheads	Galeichthys felis	1	17.0	6.7	4.14	71.0
Harvestfish	Peprilis sp.	1-2	16.4	7.5	2.31	73.0
Menhaden	Brevoortia sp.	1-2	14.9	17.8	3.66	63.3
Razorbellies	Harengula pensacolae	4	18.4	5.0	4.81	71.8
Silver eels (Cutlassfish)	Trichiurus lepturus	3	16.3	2.6	2.26	77.9
Spots	Leiostomus xanthurus	2	15.2	12.9	3.39	68.1
Star drum	Stellifer lanceolatus	9-10	15.0	3.8	4.11	76.3
Threadfin	Polynemus sp.	8	17.3	1.8	3.98	76.6
Thread herring	Opisthonema oglinum	1-2	18.6	3.5	3.27	74.4
White trout	Cynoscion sp.	1-2	17.5	5.0	3.09	74.3

People in the fish-meal, pet-food, and animal-feed industries need to know the protein, oil, ash, and moisture contents of the individual species of industrial fish. The amount of this type of information that has been available in the past has been inadequate. The project reported in this paper was initiated to supply the required data.

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Summary of results.--The results of the feeding tests are summarized in table 3 (see below).

Table 3.--Summary of experimental feeding tests with chinook salmon fingerlings

Item	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7
Initial average length--cm.	3.33	3.33	3.33	3.33	3.33	3.33	3.33
Average length at termination--cm.	5.75	5.57	5.12	4.35	4.31	4.21	5.07
Percentage of gain in length--	73	67	54	31	29	26	52
Initial average weight--gm.	0.57	0.57	0.57	0.57	0.57	0.57	0.57
Average weight at termination--gm.	2.98	2.49	1.62	0.97	0.80	0.80	1.83
Percentage of gain in weight	423	337	184	70	40	40	221
Mortality	64	1/204	749	166	278	104	527
Percentage of mortality	6.4	20.4	74.9	16.6	27.8	10.4	52.7
Total weight of food fed--gm.	2,960	2,960	2,960	2,960	2,960	2,960	2,960
Pounds of food to produce 1 lb. of fish	1.33	2.09	----	12.4	42.2	20.2	10
Efficiency factor	0.74	0.47	----	0.08	----	0.05	0.10

1/ 136 of these mortalities were due to mechanical failure.

Summary.--1. At the end of 10 weeks' feeding, only the diets with fresh liver proved satisfactory. The diet of fish meal and liver was superior to that of shrimp meal and liver. 2. A deficiency in the diet containing 50 percent fish meal and 50 percent shrimp meal resulted in 74.9 percent mortality. 3. A deficiency in the 100-percent fish meal diet became apparent in the 85th week, resulting ing in 52.7 percent mortality. 4. The commercial pellets tested were unsatisfactory as starter feeds for chinook salmon.

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This includes the cutting, skinning,and worming tables and the trays, boxes, and conveyor belts used for transporting the fillets from one place to another. Finally, immerse a fillet in a clean pail of the plant water.

5. Do absolutely nothing to the fillets in the containers labelled 1B, 2B, 3B, etc., but keep the pairs of containers (1A and 1B, 2A and 2B, etc.) together so that you can compare them later.

6. Store all the sample fillets some place in the plant where the temperature remains fairly constant in the range of 32° to 35° F.

7. Twice a day open each container and smell the fillets. Record any off-odors, as soon as they develop, opposite the container numbers on the information sheet.

What your results mean.--The fillets in the containers marked "B" are controls. If they have been cut with sufficient care, they should be slower in developing spoilage odors than most of those marked "A," and they all should last approximately the same length of time.

If there are any places in the plant where fillets are picking up excessive numbers of bacteria, the spoilage odors from these fillets marked "A" will point them out. In actual practice, as much as 3 days difference has been found between the keeping time of the controls ("B" fillets) and those that briefly touched the surfaces of certain locations in the plant.

Sometimes the rapid spoilage of commercial fillets cannot be attributed to contamination picked up from just one or two locations. In this case all or many of the surfaces of the cutting and packing lines are contributing to the bacterial load. This indicates that a general clean-up is needed.

To check on this point, in addition to the tests suggested above for single locations, send five or six of the carefully prepared uncontaminated fillets all the way through the cutting line, letting them touch all the surfaces that the fillets ordinarily come in contact with. Store these in individual containers or wrappers along with a similar number of control fillets. By comparing the length of time required for these two lots of fillets to spoil under similar storage conditions,you will get some idea of how much your normal treatment of fillets cuts down on their keeping time.

These tests should be made just before noon or just before the cutting line closes down for the day, before any attempt has been made to wash down the tables or clean up the cutting line.

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chemical studies, the homogenate was diluted to 30 ml. with water, and the supernatant liquid was separated by centrifugation at 1400 times gravity.

Carotenoids were estimated in chloroform solution, after saponification and chromatography, as described by Thompson (1949). All chemical estimations of vitamin A were made by the Carr-Price test. The spectrophotometer and method of Thompson (1949) were used to measure the intensity of the blue colors produced by vitamin A_1 alcohol and by vitamin A_1 aldehyde at their respective maxima, 620 and 664 mμ. The Beckmann spectrophotometer was used to determine absorption curves in the ultraviolet and in the visible regions of the spectrum in matched quartz cells of 1-centimeter light path. For chick liver-storage assay, a method based on that of Ames and Harris (1956), but with smaller doses of vitamin A,was used.

Results.--The biological vitamin A activity of herring eggs is about ten times greater than is the chemically determined content of vitamin A ester and alcohol. About 70 percent of the biological activity could be extracted with light petroleum in the presence of ethanol. These extracts accounted for 2.4 to 4.7 μg. of vitamin A_1 aldehyde per gram of eggs and for smaller quantities of vitamin A_1 ester and alcohol. Small quantities of carotenoids, mainly xanthophylls, also were present. Most of the vitamin A_1 aldehyde is linked to some other substance in such a way that its characteristic properties are masked. Free aldehyde is liberated by chromatography through water-weakened alumina.

Eggs from seven other species of marine teleost fish included in this study contained vitamin A_1 aldehyde at concentrations of 1 to 3 μg. per gram. The concentration of the combined ester and alcohol forms was about one-tenth of that in the aldehyde form.

0.31 CONJUGATED FATTY ACIDS

Tsuchiya, Yasuhiko and Kayama, Mitsu (Tokoku Univ., Sendai)
Tokoku J. Agr. Research 9, 41-52 (1958)
Chemical Abstracts 52, 20697 (November 25, 1958)

III. Fat absorption and distribution study in fish. --1. Application of the conjugated fatty acids for the research on the fat metabolism of Cyprinus carpio.

0.31 MECHANISM OF FATTY-ACID SYNTHESIS V. BICARBONATE REQUIREMENT FOR THE SYNTHESIS OF LONG-CHAIN FATTY ACIDS

Gibson, David M.; Titchener, Edward B.; and Wakil, Salih J. (Univ. of Wisconsin, Madison)
Biochim. et Biophys. Acta 30, 376-83 (1958) (In English)
Chemical Abstracts 53, 5359d (March 25, 1959)

The synthesis of long-chain fatty acids from acetyl coenzyme A was catalyzed by two highly purified enzyme fractions from avian liver in the presence of adenosinetriphosphate, Mn^{++}, HCO_3^-, and reduced triphosphopyridinenucleotide (TPNH).

0.34 SOLUBILITY OF TISSUE PHOSPHATIDES IN ACETONE

Lucas, C. C.; Patterson, Jean M.; and Ridout, Jessie H.
Archives of Biochemistry and Biophysics 78, No. 2, 546-554 (December 1958)

Treatment of plant and animal tissues with acetone extracted considerable amounts (from about 10 to 95 percent) of the total phosphatides. Of the animal organs tested, muscle gave up the largest proportion of its phosphatides to acetone; brain the least.

Considerable unsuspected loss of phosphatides may occur if acetone is used for preliminary drying of tissues or to remove simple lipides.

0.34 FLAVINES. 1. DISTRIBUTION AND FORMS OF FLAVINES IN ANIMAL AND PLANT TISSUES

Mitsuda, Hisateru; Kawai, Fumio; and Miyoshi, Toshio (Kyoto Univ.)
Nippon Nogei Kagaku Kaishi 32, 847-51 (1958)
Chemical Abstracts 53, 7264d (April 25, 1959)

A fish muscle on the market contained 50 percent flavine-adenine dinucleotide, and 36 percent flavine mononucleotide.

0.36 (Cross Reference: 2.02)

ON THE TERMINAL OXIDASE SYSTEM IN MARINE LAMELLIBRANCH TISSUES

Kawai, Kiyozo
Bulletin of the Japanese Society of Scientific Fisheries 23, No. 11, 738-742 (1958) (English abstract, figures, and table)

This paper is concerned with the effects of inhibitors on the endogeneous respiration of various tissues of the oyster, the pearl oyster, and the mussel (Mytilus crassitesta), and the identification of the cytochromes in the tissues. The respiration of marine lamellibranch tissues other than the gill is mediated through the cytochrome system.

0.36 THE SWELLING OF COLLAGEN AND ITS PREVENTION BY ADENOSINETRIPHOSPHATE (ATP)

Balo, Jozsef and Banga, Ilona (Orvostudomanyi Egyetem I. Korbonctani Kiserleti Rakkutato Intezete, Budapest, Hung.)
Magyar Tudomanyos Akad. Biol. Orvosi Tudomanyok Osztalyanak Kozlemenyei 9, 75-86 (1958)
Chemical Abstracts 53, 1428i (January 25, 1959)

0.38 PRINCIPLES OF STRUCTURE AND ENERGY CORRESPONDENCE IN ENZYMATIC CATALYSIS

Balandin, A. A. (The N. D. Zelinskii Institute of Organic Chemistry, Academy of Sciences, USSR, Moscow)
Biochemistry (U. S. S. R.) 23, 443-452 (May-June 1958)

0.38 ISOLATION OF THIAMINE DEGRADATION PRODUCTS FORMED BY SHELLFISH THIAMINASE

Fujita, Akiji and Ueda, Kioshi (Biochemical INST., Kyoto)
J. Vitaminol. 4, 163-71 (1958)
Chemical Abstracts 53, 3321a (February 25, 1959)

Thiamine was decomposed by crude thiaminase of clam viscera and the pyrimidine derivatives formed were separated by gradient elution using Amberlite XE-64. Of the three crystalline derivatives, one was identical with 2-methyl-4-amino-5-hydroxymethylpyrimidine-HCl, the other two had R_f values lower than for thiamine, absorption maximum at 237 and 279 mμ at pH 6.5, and absorption spectra which changed with pH change of the medium.

0.38 FISH MUSCLE AMYLASE

Andreev, A. K. (Higher Inst. National Econ., Varna, Bulgaria)
Biokhimiya 23, 899-903 (1958)
Chemical Abstracts 53, 5527e (March 25, 1959)

Fish muscle amylolytic activity was found to be of a high level in fresh and sea water fish.

LIST OF PUBLICATIONS REGULARLY ABSTRACTED

Analyst
Analytical Chemistry
Archives of Biochemistry and Biophysics
ASHRAE Journal (formerly Refrigerating Engineering)
Biochemical Journal
Biochemistry (U.S.S.R.)
Bulletin of the Faculty of Fisheries, Hokkaido University
Bulletin of the Japanese Society of Scientific Fisheries
California Fish and Game
Canadian Fisherman
Canadian Journal of Biochemistry and Physiology
Canadian Journal of Chemical Engineering
Canadian Journal of Chemistry
Chemical Abstracts
Chemical and Engineering News
Chemical Engineering
Chemical Processing
Chemistry and Industry
Commercial Fisheries Review
Drug and Cosmestic Industry
Federation Proceedings
Feed Bag
Feedstuffs
Fish Boat
Fisheries Newsletter (Australia)
Fish. Res. Bd. Can., Prog. Repts. Atlantic Coast Stas.
Fish.Res. Bd. Can., Prog. Repts. Pacific Coast Stas.
Fishing Gazette
Food Engineering
Food Manufacture
Food Preservation Quarterly
Food Processing
Food Research
Food Technology
Frosted Food Field
Industrial and Engineering Chemistry
Industrial Refrigeration
Journal of Agricultural and Food Chemistry
Journal of Applied Chemistry
Journal of Biological Chemistry
Journal of Nutrition
Journal of the American Chemical Society
Journal of the American Dietetic Association
Journal of the American Oil Chemists' Society
Journal of the Association of Official Agricultural Chemists
Journal of the Fisheries Research Board of Canada
Journal of the Science of Food and Agriculture
Maine Coast Fisherman
Modern Packaging
Modern Refrigeration
National Fisherman
National Provisioner
Nature
Nutrition Reviews
Pacific Fisherman
Poultry Science
Progressive Fish-Culturist
Quick Frozen Foods
Report of the Food Investigation Board (Great Britain)
Science
Seafood Merchandising
Trade News (Fisheries Department, Canada)
Western Canner/Packer
Western Fisheries
World Fisheries Abstracts
World Fishing

Articles chosen for abstracting or inclusion as bibliographical references are those deemed of interest to the commercial fisheries and to fishery technological laboratories. Occasionally pertinent articles from sources other than the above-listed publications are included. Biological papers are generally omitted.

0.4 THERAPEUTICALLY ACTIVE SUBSTANCES FROM CRUSTACEANS AND MYRIAPODS

Vlassopoulos, Vlassios and Logothetis, Minas
Ger. 948, 735
Chemical Abstracts 52, 17630 (October 25, 1958)

Therapeutically active substances especially valuable in treating leprosy are obtained from Oniscus murarius, Porcellio scaber, Armadillidium officinarum, Anilocra physodes, and Glomeris marginata. These organisms are extracted with $CHCl_3$ and allowed to stand with the extraction solvent for several days. Removing the solvent and dissolving the residue in water gives a therapeutically active extract which is purified.

0.4 THE EFFECT ON HUMAN SERUM-LIPIDS OF A DIETARY FAT, HIGHLY UNSATURATED, BUT POOR IN ESSENTIAL FATTY ACIDS

Ehrens, Edward H., Jr.; Insull, William, Jr.; Hirsch, Jules; Stoffel, Wilhelm; Peterson, Malcolm L.; Farquhar, John W.; Miller, Theodore; and Thomasson, H. J.
The Lancet, pp. 115-119 (January 17, 1959)

(Abstract of this article appears under 4.91 page 11 - July 1959)

1.81 STRUCTURE AND FUNCTION OF THE KIDNEY IN THE OYSTER

Fingerman, Milton and Fairbanks, Laurence D. (Department of Zoology, Tulane University, New Orleans, Louisiana)
Commercial Fisheries Review 19, 10 (November 1957)

1.81 TECHNICAL NOTE NO. 50 - EFFECTS OF TEMPERATURE AND SALINITY ON CILIARY ACTIVITY IN THE OYSTER CRASSOSTREA VIRGINICA

Fingerman, Milton
Commercial Fisheries Review 21, 10-11 (February 1959)

Both temperature and salinity profoundly affect ciliary activity in the oyster Crassostrea virginica and thus presumably affect profoundly the overall condition of the oyster.

2.00 DECOMPOSED MEAT OF TUNAS AND MARLINS. I. OBSERVATION AND STATISTICAL ANALYSES OF MEATS COLLECTED IN THE SOLOMON SEA DURING THE SUMMER, 1953

Asakawa, Suezo and Suda, Akira (Nankai-ku Suiken, Kochi)
Nankai-ku Suisan-Kenkyusho Hokoku 5, 169-78 (1957)
Chemical Abstracts 52, 15776 (September 25, 1958)

Decomposed meats of fish are roughly classified into three groups: Azuki, Sashi, and Konnyaku.

II. Components and development of the jellied meat.--Ibid. 179-186. Degeneration of meat takes place when fish is kept in ice and the meat becomes jellied by the action of cathepsin-like enzyme present in it.

2.00 SEA ODORS

Guillot, M. (Fac. pharm., Paris)
Recherches Roure-Bertrand fils and Justin du Pont No. 7, 10-28 (1957)
Chemical Abstracts 53, 2537i (February 10, 1959)

A review, with 17 references, on the odors of the products of animal and plant marine life. The principal odorous compounds are amines, sulphur compounds, and oxygenated substances containing ethylenic bonds and aldehydic or ketonic functions. The volatile constituents of algae are acetic, propionic, butyric, and valeric acids, furan, furaldehyde, methylfuraldehyde, p-creosol, α-pinene, d-limonene, p-cymene, linalool, α-terpineol, carvone, geraniol, and cineole.

2.01 THE SOFTENING SPOILAGE OF FISH SAUSAGE III. AN ANAEROBIC STARCH DIGESTION BY BACILLUS CIRCULANS ISOLATED FROM SOFTENED PART OF FISH SAUSAGE AND OTHER BACILLUS SPECIES

Uchiyama, Hitoshi; Yokoseki, Motonobu; and Motohashi, Kootaro (Tokai Regional Fisheries Research Laboratory)
Bulletin of the Japanese Society of Scientific Fisheries 24, No. 5, 370-377 (1958) (English abstract and tables)

2.01 THE ACTION OF PSEUDOMONAS ON FISH MUSCLE: 3. IDENTIFICATION OF ORGANISMS PRODUCING FRUITY AND ONIONY ODORS

Castell, C. H.; Greenough, Maxine; and Dale, Jacqueline
Journal of the Fisheries Research Board of Canada 16, 13-19 (January 1959)

(Abstract of this article appears under 0.5 page 1 - July 1959)

2.01 THE ACTION OF PSEUDOMONAS ON FISH MUSCLE: 4. RELATION BETWEEN SUBSTRATE COMPOSITION AND THE DEVELOPMENT OF ODORS BY PSEUDOMONAS FRAGI

Castell, C. H. and Greenough, Maxine F.
Journal of the Fisheries Research Board of Canada 16, 21-31 (January 1959)

(Abstract of this article appears under 0.5 page 1 - July 1959)

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3.12 CHEMICAL PRESERVATION OF MARINE PRODUCTS

Tetsumoto, S.; Okitsu, T.; and Fukuta, M. (Tokai Regional Fisheries Research Station, Tsukishima, Tokyo, Japan)
Proc. Indo-Pacific Council, 6th Session, September 30 - October 14, 1955, Section II, pp. 288-302 (1956) (Bangkok)

3.12 BORIC ACID-FREE PRESERVATION OF FRESH SHRIMPS AND SHRIMP MEAT II.

Ludorff, W.; Hennings, Chr.; and Neb, K. E. (Inst. Fischverarbeitung Bundesforschungsanstalt Fischerei, Hamburg, Ger.)
Z. Lebensm.-Untersuch. u. -Forsch. 108, 330-41 (1958)
Chemical Abstracts 53, 3529c (February 25, 1959)

Tests were made on cooking fresh shrimps 2 minutes at 90° and 100° and preserving them with boric acid and a commercial preservative containing boric acid ester, p-hydroxybenzoic acid, and sorbic acid. The latter at 100 mg. was more efficient than boric acid at 300 mg. per 100 g. of shrimps.

3.12 SALT TABLETS CONTAINING ETHYLENEDIAMINETETRAACETIC ACID

Ladenburg, Kurt (to International Salt Co.)
U. S. Patent 2,868,655 (Jan. 23, 1959)
Chemical Abstracts 53, 6482d (April 10, 1959)

Tablets containing Ca Na ethylenediaminetetraacetic acid are prepared by wet-granulating, drying the paste, grinding, adding a binder (Ca stearate), and compressing. The tablets are used as preservatives in canned seafoods.

3.39 STUDIES ON GROWTH AND TOXIN PRODUCTION OF CLOSTRIDIUM BOTULINUM, TYPE E IN FISH BYPRODUCTS. I. ON THE GROWTH IN RELATION TO THE OXYDATION-REDUCTION POTENTIAL IN THE FISH FLESH

Ando, Yoshiaki and Inoue, Katsuhiro
Bulletin of the Japanese Society of Scientific Fisheries 23, Nos. 7 and 8, 458-462 (1957) (English abstract, figures, and table)

The growth and the toxin production of Cl. botulinum Type E in fish flesh was investigated in order to clarify the outbreaks of Type E botulism through the eating of fish products and to find a preventive procedure. The present report deals with the correlation between the growth and oxidation-reduction potential in fish flesh.

3.39 PREVENTING STRUVITE FORMATION IN THERMALLY TREATED SEAFOODS

Fellers, Carl R. and Zachowski, Walter A. (to Blue Channel Corp.)
U. S. Patent 2,870,025 (Jan. 20, 1959)
Chemical Abstracts 53, 6482c (April 10, 1959)

The addition of 250 to 2000 p.p.m. $Al_2(SO_4)_3 \cdot 18H_2O$ based on seafood plus brine to canned seafood, followed by thermal treatment, prevents struvite formation. If the amount of $Al_2(SO_4)_3 \cdot 18H_2O$ added is not sufficient to completely inhibit crystal formation, the crystals are so small that they are not objectionable, and can be detected only by careful examination.

4.11 SOLVENT FRACTIONATION OF FISH-OIL GLYCERIDES

Marumo, Hideo and Tomiyama, Shinichi (Lion Fat and Oil Co., Tokyo)
Yusha Kagaku Kyokaishi 3, 6-9 (1954)
Chemical Abstracts 53, 7630b (April 25, 1959)

Cuttlefish oil after interesterification at 10° with NaOMe catalyst was fractionated with polar solvents into dewaxed oil almost free from saturated acids and crystallized stearin.

4.11 APPLICATION OF COUNTERCURRENT DISTRIBUTION TO THE STUDY OF LIPIDES

Ahrens, Edward H., Jr. (Rockefeller Inst. for Med. Research, New York, N. Y.)
Biochem. Problems Lipides, Proc. Intern. Conf., 2nd, Ghent 1955, 30-40 (Pub. 1956)
Chemical Abstracts 53, 7301f (April 25, 1959)

A discussion with 18 references.

4.11 DETERMINATION OF SOME SHORT-CHAIN DICARBOXYLIC ACIDS IN URINE BY PAPER CHROMATOGRAPHY

Stalder, Karlheinz (Max-Planck-Ges., Göttingen, Ger.)
Z. physiol. Chem. 311, 221-6 (1958)
Chemical Abstracts 53, 2341g (February 10, 1959)

A method is presented for the determination of malonic, methylamalonic, and succinic acids.

8.42 CHANGES IN COMPOSITION OF SOLE DURING REFRIGERATION

Thurston, Claude E.
Commercial Fisheries Review 20, 21-22 (August 1958)

(Abstract of this article appears under 2.15 page 5 - February 1959)

8.42 THE CHEMICAL COMPOSITION OF SEA WATER IN THE VICINITY OF THE ATLANTIC PROVINCES OF CANADA

Young, E. Gordon and Smith, D. G. (National Research Council, Halifax, Nova Scotia); and Langille, W. M. (Nova Scotia Agricultural College, Truro)
Journal of the Fisheries Research Board of Canada 16, 7-12 (January 1959)

Surface sea water from eight locations around the coast of the Atlantic Provinces of Canada was assayed quantitatively for major and minor chemical constituents. Except for sea water in the Bras d'Or Lakes of Cape Breton Island, Nova Scotia, which showed considerable dilution, averages for chlorinity and salinity were, respectively, 1.717 and 3.103 percent and averages for Na, K, Ca, Mg, SO_4, and B as H_3BO_3 were, respectively, 9.55, 0.34, 0.37, 1.15, 2.36, and 0.0243 grams per kilogram. Trace elements reported in micrograms per liter ranged within the following limits: arsenic as AS_2O_3, 1.4 to 2.0; Co, 0.33 to 0.67; Cu, 13 to 22; F, 860 to 1200; I, 6 to 53; Mo, 6.3 to 14.0; PO_4, 5 to 69; Si, 44 to 95; Zn, 6.5 to 10.9; and Ni, a trace.